The boy's own workshop; or, The young carpenters

Jacob Abbott

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EBENEZER IN HIS WORKSHOP.

THE

BOY'S OWN WORKSHOP;

OR,

The Young Carpenters.

BY

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PREFACE.

The object of this little book is to assist boys to occupy themselves, and to aid the parent in finding amusement and employment for them, by explaining to them the nature of such mechanical operations as they can safely and properly prosecute with the assistance of the instructions here given.

Many readers will perhaps actually undertake some of the operations here described, and so reduce the instructions to practice. Others will not do this; but the author hopes that these also may derive pleasure and advantage from the perusal of the book, through the knowledge which they may acquire from them of the various mechanical and philosophical principles which their years and their state of mental development enable them to comprehend and appreciate, and which the incidents narrated in the several chapters, and the conversations accompanying them, are intended to elucidate and explain.

THE

BOY'S OWN WORKSHOP.

CHAPTER I.

HOW THE WORKSHOP ORIGINATED.

ONE day John Gay's little brother Benny was playing about the floor with his kitten, while his mother was at work sewing, near a window. There was a table in the room not far from the window, with a great deal of work upon it, and there were various shreds and pieces of white cloth lying around the table and under it upon the floor.

The way that Benny was playing with his kitten was this. The kitten was under the table. Benny had a feather tied to the end of a long thread. He would throw the feather down upon the carpet in front of the place where the kitten was, and then, drawing it along by the thread, would entice the kitten to dart out at it and attempt to seize it.

"Mother," said Benny, "do you suppose that the kitten thinks this feather is a mouse?"

"Very likely," said his mother.

"Some sort of white mouse, I suppose," said Benny.

However this may have been, the kitten darted out repeatedly and very eagerly at the feather, trying to seize it in her paws, until at length she happened to clap her paw upon it just as Benny pulled away the string, and so the string came off.

"There now, Mungo!" exclaimed Benny, "you have done some mischief! You have pulled off the mouse from the string!"

Mungo was the name of the kitten. Benny's brother John had given her that name because she was so black. She was as black as jet, and her fur was very smooth and glossy.

Benny seized the kitten somewhat roughly, and the kitten, in struggling to get away from him, scratched him. He cried out a little at the pain, and let the kitten drop, when she immediately ran away.

He bore the scratch pretty well, and, taking up the feather, began to play with it by blowing it up into the air. He amused himself in this way for some time, until at length the feather happened to come near the fire-place, and the draught of air passing into the chimney drew it in, and it suddenly disappeared.

"There, now!" exclaimed Benny; "I have lost my feather!"

"Never mind," said his mother. "There are plenty of other things you can do. I wish you would pick up all these little shreds and pieces on the floor for me."

But, instead of doing this, he sauntered towards the sofa and sat down.

"Can you not do that for me?" asked his mother.

"Why, mother," said Benny, "I'm very tired."

However, he rose from the sofa and began to pick up the shreds from the floor; but he did it in a very listless and languid manner; and, after a little time, he sat down upon the carpet and exclaimed, with a sigh,—

"Oh, dear me!"

"Why, what is the matter with the boy?" asked his mother.

"I'm so tired!" replied Benny, with a dismal sigh.

"I wish you would explain one mystery to me," said his mother. "There is something about children that I can't possibly understand. It is why they never can find pleasure in doing what is useful. The moment that anything that they are doing can be turned to an useful account, that spoils all the pleasure of it,—at least it seems so to me."

"But, mother," said Benny, in an expostulating tone, "I really am very tired."

"Yes," said his mother, "that is just it. As long as you had nothing but a feather to pick up, which did no good to anybody, you were not tired. You ran about and seemed to have twice as much strength as you required. But as soon as your feather was gone, and I wished you to pick up shreds and pieces instead, which might have done some little good, then all at once you became *so* tired."

While his mother had been speaking to him, Benny had left the sofa and gone to her chair, and now he stood by her knee, leaning upon her; and she began, as she finished what she was saying, to tickle him under his arms, by which action he knew that she was not much displeased with him after all. He laughed and jumped back out of the way, and then said,—

"Well, mother, I don't believe that anybody that is so little as I is meant to do much good. We are only meant to enjoy ourselves.

His mother smiled.

"Do you suppose that Mungo is meant to catch real mice now while she is so little?" asked Benny.

"No," said his mother, "I don't think she is. We ought not to expect it of her. She is only fit to run after feathers."

"Would it have helped you very much if I had picked up the pieces on the floor?" asked Benny.

"Oh, no," said his mother; "very little. Dorinda will come and brush them all up by-and-by. But there is one thing that you can do that will really help me. Go up to my chamber and bring me down my thimble, which you will find on the window there."

"Oh, mother, it is so cold up-stairs!" said Benny.

"Is it very cold?" asked his mother.

"Yes, mother, it is very cold indeed," said Benny. "There is frost on all the windows."

"Very well, then, you need not go," rejoined his mother. "I thought perhaps you were brave enough not to mind a little cold. But I admit you are right in thinking that children as young as you were not intended to do much good. I should be glad to compromise with you, and release you from doing any good, on condition of your not doing any mischief."

"But, mother," said Benny, "I *don't* do any mischief."

"Sometimes," said his mother. "When I gave you a pair of scissors the other day, you cut the hair all off the top of pussy's head, under pretence that you were a barber, and that she was a customer."

"I thought she would look better," said Benny, casting down his eyes, and appearing somewhat confused.

"She did not look better," said his mother; "she looked a great deal worse; and so you did mischief."

Benny looked down, but did not reply.

"How would you like to make a compromise with me?" asked his mother.

"A compromise?" repeated Benny.

"Yes," said his mother. "A compromise is a sort of agreement to divide what is in dispute. The compromise which I propose is this, that I am not to expect you to do any good, and that you, on your part, agree never to do any mischief."

"Well," replied Benny, "I will agree to that."

"And will you keep to your agreement faithfully?" asked his mother.

"Yes," said Benny, "I will."

"Remember, then, that the agreement is made; and if you forget and do any mischief, then I am entitled to call upon you to do something useful enough to make up fully for the damage."

"Yes, mother, I understand it perfectly," replied Benny.

Benny's brother John was three years older than Benny. He was ten, while Benny was only seven. He was at school on the day that Benny had his adventure with the feather, and made the compromise with his mother.

A little after twelve o'clock the same day, as Benny was sitting in a low chair near the desk, holding Mungo in his lap, and looking at the pictures in a picture-book, John came in from school.

"Benny," said John, "I have got my slate mended."

"Who mended it for you?" asked Benny.

"Ebenezer," said John. "I have been to his shop."

Ebenezer was a farmer's boy who lived quite near. He was rather a young man, being more than eighteen years of age. He was very good-natured, and had a shop in a sort of half basement and half cellar at the end of a shed, where he used to work, sometimes, mending his father's tools, or making things to be used on his father's farm.

"Ebenezer is a good fellow," said Benny.

"Yes," said John; "but I wish I had some tools of my own, and then I could mend my things myself. I'm going to ask my mother to buy me some. We can buy a very good chest of tools for boys for thirty shillings."

"How big a chest?" asked Benny.

"As big as that," said John, showing with his hands, by holding them apart at the proper distance. "I saw one in a shop-window. Thirty tools in it. I could do almost anything with thirty tools."

At dinner-time that day John asked his mother about the tools. He had nothing to do in the house, he said, in stormy days in winter, and the tools would be just the thing for him. They would only cost thirty shillings.

"If you could only contrive some way to earn the money," said his mother.

"Well, mother, how *can* I earn the money?" replied John. "I am willing to work, if you can only find me something to do."

"You are not strong enough to do any manual labour, John; but there is another way of earning money than by mere strength, which is much easier."

"What other way?" asked John.

"By skill," said his mother; "that is, provided you have skill. But, unfortunately, boys of your age, while they have not much strength, have usually less skill, and so it is very hard for them to earn money in any way."

"I wish there was some way or other that I could earn the money," said John, "for I want a chest of tools very much indeed."

"I would buy them for you myself," said his mother, "if I were sure that you could do anything with them."

"Oh, I am sure I could work with them," said John. "I have seen Ebenezer work with his tools so much, that I know all about it."

"I wish you would ask Ebenezer," said his mother, "the next time you go to his shop, whether he thinks you could do anything with a chest of tools. If he says, decidedly, that he thinks you can, then I will buy you one. If he says you cannot, then I shall not think it best to buy you one; but you may buy one yourself, if you can find any way to earn the money."

"How *can* I earn the money?" asked John.

"Do you wish to do it by strength or by skill?" asked his mother.

"I would rather earn it by skill, if I could," said John.

"There is one thing," said his mother, "that perhaps you might do. You might help me take care of Benny. You do help me to take care of him, as it is, a great deal. You take him out to play with you, and when he feels cold you come in with him sometimes, though you have to give up your own amusement in order to do it. Then, when he gets hurt, you know how to take care of him and comfort him. All that is *skill*, and I think you can earn money more easily by that than you can by your strength in any way."

John was very much pleased to hear these commendations, but he did not reply.

"But sometimes *he* troubles me a good deal," said Benny, speaking in a low and timid tone.

What Benny said was very true. Like almost all other boys, though often kind and attentive to his little brother, John was sometimes rough and impatient with him; and not unfrequently disputes and difficulties arose, which occasioned their mother a good deal of trouble to settle. Mrs Gay did not, however, take any notice of what Benny said, or allude to these troubles at all. She understood the principle, so important in the management of children, that they are much more easily led to make efforts to correct their faults and make improvement, by having what they do that is *right* noticed and encouraged, than by having what is wrong pointed out to them, and being censured for it. So she took no notice of what Benny said, but went on as follows:—

"I will tell you what I am willing to do for you. I will appoint you to an office, and give you a salary, so long as you perform the duties of it skilfully and safely. I appoint you Benny's special friend. The duties of your office are to take care of Benny so far as you can, so as to relieve me as much as possible. You are to teach him all you can of whatever it will be useful for him to know, and help to amuse him and make him happy. You are to take care, when he is out at play with you, that he does not get hurt, and does not tear or soil his clothes, nor go into any dangerous places; and, in a word, act as his special friend on all occasions. It will require considerable skill and patience to do this well, and perhaps you will not succeed. But if you do succeed, and so long as everything goes on well, I will pay you one shilling a week as your salary."

"But, mother, suppose Benny won't mind what I say," said John.

"Ah, but I don't give you any particular authority over him," said his mother. "I appoint you his *friend*, not his master or governor. And there is the difficulty. It will be hard for you to get along smoothly and pleasantly with him, without having any absolute authority. If you have skill enough you can manage it, for you understand this is an office in which you are going to earn your salary by skill, and not by strength. If you find you have the skill, you will earn your money very easily; but if you have not the skill, and cannot acquire it, then you won't be able to earn it at all, and will have to give up the office. Would you like to try it?"

"Yes, mother," said John, "I should like to try it very much. But how long will it take me to earn money enough to buy my tool-chest?"

"Ah, it will take a great while," said his mother. "It will take thirty weeks. But you must remember, that if Ebenezer says he thinks you can do anything with the tools, I will buy the chest for you myself, and then you can have your salary for other things. But if he thinks it is doubtful, then you must buy it with your own money. Only you would not have to wait thirty weeks; for if I find you are getting along well in the duties of your office, then, as soon as you have earned one five shillings, I will lend you the other twenty-five, and you can pay me back as fast as your salary comes in."

John said he would go and ask Ebenezer that very afternoon.

"And I am sure he will say that I can use the tools," said he.

"Did you ever try to do any work in Ebenezer's shop?" asked his mother.

"No," said John; "I have not worked exactly, myself. I have only seen Ebenezer work. He is very strict in not letting any boys touch his tools."

"I wish *I* could have a salary, too," said Benny.

"Very well," said his mother. "You shall. You shall be *my* special friend, and do all you can to help and take care of me, just as John is to help and take care of you, and I will give you threepence a week for your salary."

"In real money?" asked Benny, eagerly.

"Yes, in real money," said his mother. "I will pay you every Saturday. That is, in case you are skilful and faithful, and earn the money. You must do all you can to help me. When I am tired or sick, you must be quiet and not disturb me. When there is anything you can do to help me, you must be ready and willing to do it, and try to save me all the trouble you can in every way."

Benny said he would do so, and began at once to caper about the room with joy at the idea that he, too, was going to have an office and a salary.

CHAPTER II.

EBENEZER'S WORKSHOP.

THE shop in which Ebenezer worked was in the end of a shed, or rather *under* the end of a shed, for it was at a place where the ground fell off in such a manner as to give an opportunity to make a sort of basement-room half underground. The back of the room was a wall of stone, and the floor was formed of large flat stones, laid in the form of a pavement. At one side was a fire-place, where, on the days when Ebenezer was at work, there was always a great blazing fire, formed of all sorts of irregular and misshapen masses of wood, mingled with abundance of chips and shavings from the work-bench.

Ebenezer chose this place for his shop because it was safe, on account of the stone walls and stone floor, in respect to fire. There was, however, one disadvantage attending it, and that was, that the dampness of it made the tools rusty. But though the surfaces of Ebenezer's tools looked black, the edges of them he kept so sharp and keen that it was a real pleasure to use them.

On the day when John went into the shop to ask Ebenezer's opinion about his buying some tools, he found him employed in mending the hay-rakes, by putting in new teeth to replace those that had been broken during the last summer in the work of haying.

"Ebenezer," said John, "what are you mending your rakes for at this time of the year? Do you expect to have any hay to make while there is so much snow on the ground?"

Ebenezer made a slight inarticulate sound in answer to this question, and went on with his work, as if he did not consider it worthy of any further notice.

"Ebenezer," continued John, "I have come to ask you a question for my mother. I want her to buy me a chest of tools, and she says she will, if *you* think it is a good plan. And I knew you would think it was a good plan."

"No," said Ebenezer, "I don't think any such thing."

"Why not?" asked John, much surprised.

"Because boys can't do anything with carpenter's tools," said Ebenezer.

"Why, yes," said John, "I could make a great many things with them. Think how many things you can do with your tools."

"What you need most," said Ebenezer, "in making things is skill, not tools."

"Skill!" repeated John, much surprised. "We could not do anything if we had ever so much skill, unless we had tools to work with."

"That is possible," said Ebenezer; "but still, if you have skill, you can do a great many things with very few tools, but without the skill you cannot do anything, if you have all the tools in the world. To give a chest of tools to a boy who does not know how to use them, is like giving a pair of spectacles and a telescope to a blind man."

"But how am I ever to learn how to use tools," asked John, "if I don't have any to try? You never will let me use any of yours."

"Buy one at a time," said Ebenezer, "and learn to use that, and then gradually buy others as you come to want them. In a chest of tools there would not be one that you would know how to use just now. I don't believe you know how to bore a hole with a gimlet."

"Oh, yes, I do," said John. "Let me have one of your gimlets, and I'll let you see."

"Very well," said Ebenezer, "I'll do it." So saying, he took down from his tool-rack a small gimlet, and gave it to John, together with a small and quite narrow piece of wood. The piece of wood was a long square stick; in fact, not more than half an inch wide. Ebenezer, in giving John the gimlet, made a little prick with the point of it in the wood, very near the end, and directed him to bore a hole there.

John began to bore, but pretty soon Ebenezer, as he expected, heard a little crack, while John suddenly stopped, and exclaimed,—

"Ah, it has split."

"Yes," said Ebenezer; "that's what I expected."

"Well, that is because it is such a thin piece of wood."

So saying, John threw his split stick away, and came up to the end of Ebenezer's bench, and began examining the point of the gimlet, to see if there could be anything wrong there.

There was nothing wrong. The gimlet was

very sharp, and in excellent order in all respects.

"It must be because it was such a thin and slender piece of wood," said he. "If you would give me a good big board, and let me bore a hole in the middle of it, where it is strong, I could do it well enough."

"Yes," said Ebenezer, "no doubt; but when you are at work, making anything for a useful purpose, the hole that you will wish to bore won't always come in the middle of a great big board. In fact, it will be much more likely to come very near the edge of the board, or in some slender and narrow piece which will split easily. So you can't pretend to know how to use a gimlet, until you can bore a hole with it anywhere."

"I wish you would show me how to do it," said John.

"I can't leave my work to show you," said Ebenezer; "but I will tell you something about it while I go on mending my rakes. You see my time is not my own, and I have no right to give it away to boys."

"Whose is it, if it is not yours?" asked John.

"My father's," said Ebenezer. "All my time now is his, and I am bound to use it for his benefit, faithfully, till I am twenty-one, to pay him for all the care he took of me when I was a baby and a little boy."

"Is that the law?" asked John.

"Yes," said Ebenezer. "That's the moral law for everybody—for you as well as for me. Your mother has taken care of you, and given you all you wanted to eat and wear, and a house to live in, ever since you were born; and the law is, that as soon as you are able to do anything for her, or to help her in any way, you are bound to do it, and to give her all your time and services until you are twenty-one years old."

No doubt that Ebenezer was correct in this statement. And this principle is not only according to law, but it is according to natural justice and right. Parents do not always require their children to do what the law thus makes their duty; but it is out of pure kindness and generosity toward them that they release them. And even if children faithfully fulfil their obligation, as Ebenezer did, they then do not half repay the care, anxiety, and trouble which they caused their parents in their earlier years.

Ebenezer did not leave his work to show John how to bore, but went on making teeth for his rake by means of a chisel, while he gave John a sort of lecture on the subject of borers and boring.

I shall only give the substance of what Ebenezer taught John about these matters while they were talking together at the bench in Ebenezer's shop, without pretending to relate all the conversation, as that would take up too much space.

"There are," said Ebenezer, "two kinds of tools which are used for boring small holes in wood, namely, gimlets and brad-awls. The difference between them is this, that gimlets bore by cutting away the wood and bringing up the little chips and borings that they make, out of the hole, as fast as the gimlet goes in. The brad-awl, on the other hand, does not bring any wood out of the hole, but crowds it all out to one side or the other, into the surrounding wood.

"If you look at a gimlet attentively, you will see how ingeniously it is contrived to cut the wood away as it goes in, and bring the little chips up and out of the hole.

"At the end of the gimlet is a screw which runs down to a point. The object of this screw is to pierce the wood in advance of the hole, and by the threads of the screw to draw the gimlet in after it. It is hard to understand precisely how a screw, by merely being turned round, can draw the gimlet in; but so it is, and you will find that when you bore a hole with a gimlet, if it is a good one, and if the screw is in good order, you only have to turn it round and round, without having to press it down at all, excepting a little at first to get it started. After it is once started, it will draw itself in, and cut its way deeper and deeper, by your merely turning it round and round.

"Above the little screw you will see that in every gimlet there is a groove which extends a long way up the stem. This groove is twisted, so as to pass round and round the shank in a spiral direction. It has also a sharp edge on each side, which is to cut away the wood on the sides of the hole, and so enlarge the hole as the gimlet goes in; and the groove itself forms a channel for the little chips which are cut out to come up by, and get out of the hole. The groove is made in a spiral form, that the chips may be brought out more easily and rapidly, so that there will be less danger of the hole getting choked up by them.

"A gimlet, however, must be very nicely made, and be very sharp in all its cutting edges, to cut away and bring out all the wood from the hole it makes. Most gimlets crowd out into the adjoining wood a great many of the particles that they remove in making the hole. It is this crowding of the particles out on each side that makes the wood split when it is a very thin or narrow piece, or when the wood is of a very hard kind, so that it will not yield and allow itself to be compressed."

Ebenezer explained all this to John, as he stood by him at the bench, and showed him that the reason why he split his small piece of wood in boring it, was that the gimlet in going in did not cut out and bring away all the wood that was in the course of the hole, but crowded some of it aside, and that this was the force that split the stick open. He told him, too, that the way to prevent this when you have a hole to bore in a very narrow piece of wood, or at a place very near the edge of it, was to pull the gimlet out after boring in a very little way, so as to bring out all the chips and cuttings, instead of leaving a part of them in the hole, and to repeat this action after every two or three turns, and thus make room for the gimlet to advance without wedging the wood open, and so splitting it.

Ebenezer explained to John that it was only necessary to take this precaution in cases where the wood was very narrow, or the hole was to be near an edge or a corner; for in case of boring into the middle of a solid piece of wood, especially if it was soft wood, like pine, all that the gimlet could possibly do, in the way of crowding the particles of wood aside, would not be enough to split it.

Ebenezer also told John that there was another thing to be learned in the use of the gimlet, and that was how to bore straight. He told him that the way to learn this was to stop while he was boring, now and then, and hold the wood up and observe the position of the gimlet in two directions; that is, looking at it from front to back and then from side to side, to see whether it leaned either way; and then, when it came through on the other side, to see whether the hole was exactly as far from the edge as it was where it went in.

"And now," said Ebenezer, when he had given these instructions, "I advise you, instead of buying a whole chest of tools that you don't know anything about, to begin with a single gimlet that you can buy for twopence, and practise with it on pieces of wood until you can bore straight wherever you begin, and can also go through the smallest strips without splitting."

From gimlets Ebenezer went to brad-awls, which are also tools for boring small holes in wood. They are made on a different principle from the gimlet, which is contrived to cut away and take out the chips; for the brad-awl does not cut away or take out anything, but only forces its way into the wood, and crowds the material of it out of the way by main force.

"A brad-awl is called by that name because it is an awl employed for boring holes for *brads*, which are small slender nails used for light finishing work, and for nailing the sides of small boxes together.

"I suppose that almost all the readers of this book must have seen, and perhaps used, a brad-awl. The body of it is simply a round wire, ground at the edge in the shape of a sharp wedge. The edge of this wedge cuts across the fibres of the wood, and the sides of it force them away, so that by working the awl a little this way and that, and forcing it down into the wood, it makes the hole by crowding the wood off out of the way, without cutting any chips at all to come out. Of course a brad-awl will only do for small holes. Some brad-awls are very small indeed,—not larger than a coarse needle, and they increase in size from that up to the smaller kinds of gimlets. Of course gimlets may be made to bore much larger holes than brad-awls, since they cut away and bring out a large portion of the wood from the hole, while the brad-awl only thrusts it aside.

"There is a sort of projection called a shoulder, where the brad-awl goes into the handle, to prevent its being forced in too far, when bearing hard upon it in boring; and the part that goes into the handle, which is of course out of sight, is made flat, or square, to prevent its turning round in its socket when you are boring with it.

"There is one thing which it is necessary to understand about the brad-awl, which is still rather difficult to explain in a book, and that is, if the piece of wood is narrow, or if you are boring near the edge of it, so that there is danger of splitting it, then the tool must be set in with the cutting edge *across* the grain, and not lengthwise of it. If the edge is lengthwise of the grain, then the sides of the wedge, by crowding the fibres apart, tend to split the wood open. But if it is across the grain, then it does not tend to crowd the fibres apart, but only to crowd them endwise into each other, and this does not tend to split the wood at all. Thus, whether you can bore a hole in a narrow piece of wood with a brad-awl without splitting, depends altogether upon the manner of holding the tool when you force it down into the wood. If you try boring with a brad-awl through narrow or small pieces of wood, you will understand better what I mean, and you will see that it is really so."

Ebenezer told John that after he had learned to bore straight and without splitting, both with a gimlet and a brad-awl, he would not yet have learned more than half about those tools. The most difficult part remained, he said, and that was to know how to keep them in order,—that is, to use them in such a manner as not to injure them, and also to sharpen them when they get dull, and to tighten the handles again when they get loose. He said, however, he would not teach him anything about those things at that time, but would wait till after he had learned to bore holes well.

"Then you think I had better not have a chest of tools at present?" said John.

"Certainly I do," said Ebenezer. "All that a boy does with a chest of tools when he buys them, before he has learned how to use them, is to knock them about and make them dull and out of order, and get himself vexed and out of patience because he can't work with them. He forgets, or rather he does not know, that it is *skill* and not tools that is the great thing, and it is of no use to get the tools any faster than he learns how to use them.

"Besides, even if you had the tools," added Ebenezer, "you could not do anything with most of them without a bench of some kind, and a vice to hold your work in. Then you could not work in the winter with them without a fire; and as you could not have a bench and make shavings in any of the rooms in the house, you would require to have a fire on purpose in some backroom, and this would be very dangerous."

I think that this advice of Ebenezer's was very judicious. Boys often get a box of tools, either by buying them or receiving them as a present, and when they first open them and look them over, they are quite delighted with them. But they soon find three great and insuperable difficulties in the way of accomplishing anything with them. They don't know how to sharpen them and keep them in order; they don't know how to use them without splitting and breaking their work, or getting into other troubles; and they have no accommodations in the way of bench and room. It is a great deal better, therefore, in most cases, for a boy to begin with few and simple tools, and learn to use and take care of them first, and then buy more as he comes to feel the want of them. This is especially the case, inasmuch as a great deal of very ingenious and useful work may be done with very few and very simple tools, as will appear more fully by-and-by.

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CHAPTER III.

FIRST TRIALS AND DIFFICULTIES—BOX-MAKING.

When John reported to his mother that Ebenezer's opinion was that he had better not have a chest of tools at once, but only buy a few at a time, beginning with the simple ones, and then procuring more as he found he needed them and could learn the use of them, she fully approved of the plan thus recommended, and told John that she had no objection to lending him some pence in anticipation of his first week's salary, so that he might buy one or two gimlets at once, for Benny and for himself, and begin to learn to bore.

Ebenezer had told John that a drawer would be the best thing for him to use as a shop while he was learning the use of the simple tools; and so John asked his mother if she could not let him have one of the drawers in the secretary.

"The lowest drawer will be the best for us," said he, "for that is next to the floor, and so

Benny and I can sit upon the floor close by it while we are at work."

Mrs Gay assented to this, and said that she would take the things out of the drawer and make it ready for them while John was gone to buy his gimlet.

Benny wanted to accompany John when he went to purchase the gimlets, but John wished to go alone. Benny fretted at this, and John thought he would steal out and run away. He therefore gave Benny some trifling little thing to do in order to divert his attention, so that he might escape.

So while Benny was busy John slipped out of the room, put on his coat and cap, which he had placed all ready upon the table, and set off to go into town.

He had not proceeded many steps before all at once the thought came into his mind of his office and his salary. It seemed to him that it was by no means doing his best to amuse and take care of Benny to go off by stealth in that way and leave him. He knew, of course, that as soon as Benny should find out that he was gone without him, he would feel greatly disappointed, and perhaps begin to cry, and in the end perhaps put his mother to a great deal of trouble to console and comfort him.

So he determined to go back at once and offer to take Benny with him, if he wished to go. It was very honourable in him thus to remember his agreement with his mother, and to return of his own accord and fulfil it faithfully.

He came back just in time, for Benny, suspecting as it seems that something was wrong, had run out into the back hall where John kept his cap and coat, and when he found that they were gone, he at once concluded that John had been playing him a trick, and he was just beginning to cry aloud with disappointment and vexation, when John opened the door and came in.

Without appearing to take any notice of his distress, John said at once,—

"Benny, I am going now to buy the tools, and if you wish to go with me you can; but it is very cold."

Benny said that he did not care for the cold, and he wished to go very much indeed.

"You don't know how cold it is," said John. "And it is growing colder every moment. It will be down to zero to-night."

"What is zero?" asked Benny.

"I don't know exactly," replied John; "only it is a mark on the thermometer where it is dreadfully cold."

"I don't care," said Benny; and he immediately began to take down his coat and cap and mittens, and to put them on, standing by the stove in the back hall.

When Benny had put on his coat and cap, he and John went off together. In about three quarters of an hour they returned with their purchases, which consisted of a small gimlet for Benny, and a much larger one and a brad-awl for John. The brad-awl was of a size intermediate between the two gimlets. Thus with the three tools three holes of different sizes, increasing in regular gradation, might be bored.

As soon as the boys had put away their coats and caps, and warmed themselves a little, they proceeded at once to the sitting-room and opened the drawer which their mother had by this time emptied for them, and commenced their work. They first put all the blocks and pieces of wood into one end of the drawer, reserving the other end for their tools; and then each selecting a block or piece of wood, they began the work of boring, and occupied themselves with it busily for more than an hour, their mother sitting all the time at her work near the window. They encountered several difficulties however.

In the first place, John had a great deal of trouble at first in trying to make Benny bore right. He said that he was master, and Benny was his apprentice, and that Benny must follow all his directions. But Benny seemed to pay but little heed to them. The very first hole that he bored he split the wood; but instead of being sorry for this, he seemed delighted, and immediately began to bore another hole, in hopes to see it split again. In vain John assured him that this was wrong, and told him that the thing to be done was to bore *without* splitting,—and explained to him how he must do it. But Benny would not bore in that way, but went on splitting the sticks as fast as he could. Indeed, it seemed to him that it was a double excellence in his gimlet that it would split wood as well as bore it.

At last John lost his patience, and he called to his mother in a fretful and complaining tone,—

"Mother, I wish you would speak to Benny and make him bore right. He does not bore right at all, and I don't believe he tries to bore right. He does not mind in the least what Ebenezer said, and he never will learn."

"Come here a moment, John," said his mother.

So John went to his mother, and, standing by her side, began to complain of Benny's indocility.

"It seems to me," said his mother, "that Benny is too young really to learn to use carpenter's tools. I think I would not try to teach him. Let him do just as he pleases, provided he is amused. *You* can really learn, but let him only make-believe."

On a little reflection, John was convinced that this was, after all, much the best plan; and so he went back, and had no more difficulty. Benny bored his holes in all directions, and split as much wood as he could in his boring; and the more odd the course was that the gimlet took, and the more unexpected the place where the point of it came through, and also the more the wood was split and cracked by the operation, the better he seemed pleased.

Another difficulty arose about brushing up the litter that the boys found they made upon the carpet when the work was done. The gimlets, in boring, cut out from the holes they made a quantity of fine particles of wood, like sawdust, which fell upon the carpet. The boys observed this, and they promised that as soon as they had finished their work, they would sweep it all up again. They tried to do so, but they found that they could not manage it very well. Their mother finally concluded that it would be best for them to do their work in the back hall, where there was a table with a drawer in it, which would hold the tools, while they could use the table as a bench. As the floor of the hall was painted, the chips and borings which they would make could be easily swept up.

John liked this arrangement very well, for the hall was always kept warm; and then, moreover, there was no danger there of his and Benny's operations being interrupted by company.

Ebenezer told John that if he would practise boring with the gimlet and the brad-awl until he could bore straight, and without splitting, he would show him how to make boxes.

"And the first thing that you must try to make," he said, "is a nail-box. A good workman, as far as possible, makes his own implements and tools, and the first thing to begin with is a nail-box."

"And in order to make a box," continued Ebenezer, "the first thing you have to do is to get some idea of form."

"Of form?" repeated John.

"Yes," said Ebenezer; "so as to know when an edge is straight, and when one edge is square with another."

"I know that already," said John.

"Oh, no," said Ebenezer, "not accurately." And in order to put this point to the test, he asked him to look about the shop and find two strips or pieces of wood that had straight edges. The first piece which John brought was very far from being straight, and John perceived the crookedness of it the moment that Ebenezer pointed it out to him. At last, however, he found two narrow strips like rulers, that he said were perfectly straight, he was sure. Then Ebenezer directed him to put the two edges together, and hold them up to the light, to see if there was any crack to be seen between them.

John did so, and he found that though the edges touched at different places here and there, yet in other places they were a little way apart,—only a *very little* way, it is true, but still enough to let the light shine through, and thus to show that the edges could not have been absolutely straight; since, if they had been so, they would have been in actual contact through their whole length.

"Oh, I did not mean so very straight as that," said John.

"That's it, exactly," said Ebenezer. "Boys like you not only don't know whether a thing is straight or not, but they do not even know what straightness is. The first thing you have got to do in learning carpenter's work is to get some of your ideas corrected."

"Why, Ebenezer," said John, "things may be straight, and yet not so very perfectly straight that you cannot see the least glimmer of a crack between them."

"We may call them straight," said Ebenezer, "but they are not really so. They are only *nearly* straight. There is no such thing as one thing being straight, and another one straighter. The straight one is only straight, and the other is nearly straight. Still we commonly call things straight when we mean only that they are nearly straight. There is no harm in this. You may use the language just as you please, provided you have right ideas about the thing."

At first John supposed that he could not possibly make his pieces of wood straight and square for the sides of his box without a saw and a plane; but Ebenezer taught him how to do it with a sharp-pointed knife and a sheet of sand-paper. John had a knife already, and he afterwards bought a sheet of sand-paper. He had a hammer, too,—a small carpet-hammer which his mother lent him. Having provided himself with all these things, Ebenezer told him that he wanted nothing more to enable him to go to work but a stock of wood. For that he advised him to go to the cabinetmaker's and buy some pieces of thin wood, quarter-inch thick, planed smooth on both sides.

"This will be best for you to begin with; and if you will come here some day, with a basket, you may have all the blocks and small pieces you can find among the shavings under my bench. They may be of some use to you, though you can't work them much with a knife and sand-paper, because they are too thick."

Ebenezer also gave John particular instructions how to proceed in making his nail-box with these tools and materials. What these instructions were will appear by the account I shall give of the manner in which John proceeded with his work in following them.

When Saturday came, at the end of the first week of the office and salary, Mrs Gay paid John what she had promised, deducting what she had advanced to him at the beginning to buy gimlets and brad-awls. The balance which he received was sevenpence. He immediately went into the town and bought some sand-paper, and also a small paper of what are called three-quarter-inch brads. There were plenty of carpet-nails in the house, and his mother gave him a supply of these, so that he had two kinds of nails to put into his nail-box to begin with.

There is a great difference in the form of carpet-nails and brads, arising from the different purposes that they are to be applied to. A carpet-nail has a broad flat head, and is sharp-pointed at the end. The *brad*, on the other hand, has a blunt point, and scarcely any head at all,—only a small projection on one side.

The reason why the carpet-nail is made with a sharp point, is because it must make its own way into the floor, without having any hole bored for it. In putting down a carpet it would be very troublesome to have to bore a hole in the floor for every separate nail put in; and this is not at all necessary, as the boards of the floor are so thick and strong that there is no danger of splitting them, however forcibly the nails are driven in.

In the case of a brad-awl, on the other hand, which is used for fastening the sides of small boxes together, and for nailing on mouldings and other light finishings, it will not answer always to drive them in without boring, or to have the points of them sharp and wedge-shaped, as that would greatly increase the danger of splitting the wood. So the point is made blunt in order that the sides may not *spread* as they recede from it, and thus give the nail a wedge-like form to split the wood. The head, too, is made very small. The head of the carpet-nail is made large and flat, so that it may extend over several of the threads of the carpet, when it is in its place, and thus get a better hold to keep the carpet down.

But this is not necessary in the case of nailing wood with a brad, for it holds the pieces of wood together, not so much by its head as it does by the roughness of the iron along the sides. The brads are made rough along the sides, and not smooth and polished like a pin, for this very purpose—that in order by their roughness they may hold better.

There is a special reason, too, for having the head of the brad small—and that is in order that it may not show much along the side of the box, or on the face of the moulding. Indeed, sometimes the workman wishes to have the heads concealed entirely, and in this case he drives the brads in so far, by means of a little punch, that the head sinks entirely into the wood. This, of course, leaves a small hole in the wood. The painter, however, when he comes to paint the work, fills up these little holes with putty, and then paints over them; and thus the nails entirely disappear from the surface, while still they hold on *strong* within.

All these things Ebenezer explained fully to

John as he stood by his side at his bench; and every boy who can get a few brads and carpet-tacks, and who will try them a little in different pieces of wood, will easily see the truth of what has been here explained. These may seem to be little things; but it is only by close attention to little things like these, and cultivating a habit of close observation, and perceiving exactly in what ways different mechanical effects of this kind are produced, that a boy can lay the foundation for being a good workman.

And if a boy begins by studying carefully the form of the more simple tools, and observing the exact mode in which they operate, he will carry this habit with him in respect to the more complicated ones, and so will act intelligently in all his working with them. This is the only way, in fact, to become a good mechanic.

With the money which John had from his mother he went to a cabinetmaker's with his basket, and asked him to let him have as many pieces of thin wood—"quarter-inch stuff," such as is used for thin partitions in desks and for the bottoms of small drawers—as he could afford for that money.

As John was willing to take small pieces, such as the cabinetmaker had left, after cutting out what he wanted for his work, Mr Bevel (for that was his name) was willing to give him quite a large quantity of wood, much more than John expected for so little money. John put all these pieces in the basket, and Benny and he then proceeded to Ebenezer's shop to procure the blocks and other pieces which he had promised them, from under the bench. They crawled under the bench, and began searching about among the shavings, seizing everything that felt solid there, which they threw out upon the floor. They afterward looked over all these pieces and selected from them such as they thought would answer their purpose, and putting them in the basket they carried them home.

The largest of all these pieces of wood the boys stacked in a neat pile in a corner of the shed, which they concluded to call their timber-yard. The rest,—that is all the small, smooth, and neat-looking pieces,—they brought into the house and put them in the drawers which their mother had assigned them. The sand-paper and the tools they put in one end of the drawer in the back hall, and some of the wood—enough to begin upon in their work—in the other end. The prettiest and best of the blocks, such as Benny thought would be good to build houses with by piling them up on the floor, they put in the secretary-drawer in the sitting-room.

"Because, you see," said John, "there is no objection to your building houses with the blocks on the sitting-room carpet, for that does not make any chips or saw-dust; and sometimes you will want to do that while I am making things in the hall."

"No," said Benny, "I want to make things too."

"Very well," said John. "Then you can stay and make things with me. But at any rate we will keep all the smooth and pretty blocks in the sitting-room."

It was late on Saturday afternoon when the boys completed the work of procuring and laying in their stock and their tools; and several days elapsed after this before John had an opportunity to commence his work. Ebenezer advised him, if he really wished to learn to do anything with tools, to consider it *work*, and not play; and not to undertake any operations until he had ample time for them, and then to proceed step by step, in the most deliberate and cautious manner. He must never act in a hurry, he said, in order to finish something at a particular time, or attempt to work with a tool that was dull or out of order, or to use a poor or unsuitable piece of wood because he had no proper piece at hand. Such management as that, Ebenezer said, only led to disappointment, worrying, vexation, and failure.

So John resolved not to begin his work until the next Wednesday afternoon, when there was a half-holiday. Benny played with the blocks frequently during the interval, and once or twice he attempted to bore a little with his gimlet; but he soon found that there was not much amusement in working unless John was working too, and so he contented himself with building houses by piling up the blocks upon one another, and arranging them in different ways in the drawers.

On Wednesday morning at breakfast, when John was talking about beginning his work that afternoon, his mother told him that she was very glad that he was going to learn to work in wood, and she should be willing to help him by every means in her power. But there were two conditions that she must make before she could allow him and Benny to do such work in the house, or rather there were two rather stringent rules that she was going to make.

Benny wanted to know what sort of rules stringent rules were.

"Why, strict rules," said his mother,—rules that she was going to be rigid in enforcing.

Benny said he did not know what rigid meant any more than stringent.

"Rigid means stiff," replied his mother. "A thing that is not stiff is called flexible or yielding. A stem of a young tree which should be stiff enough to make a cane of, would be said to be *rigid*, while a slender switch is *flexible*,—that is, it will easily bend. Now I am going to be firm and unyielding in requiring you to comply with these two rules. And I will tell you what they are.

"In the first place, you are never to work either upon the floor, or upon a table, or any other article of furniture, without a board under your work for a protector."

"I don't know where we can get any boards big enough," said John.

"I will help you to get some boards," said his mother; "but after you are provided with them, it must be your business to see that you always use them."

"The next rule," continued Mrs Gay, "is, that whenever you leave off working you must put all your tools and materials away, and brush up all the chips and dust that you have made, so completely that nobody could discover, by the closest inspection, that you had been at work."

"That will be pretty hard," said John.

"Yes," said his mother, "it will be very hard indeed. It will be hard for you to remember always to use your boards, and it will be very difficult indeed for you to clear away your litter so perfectly. But I shall be strict and rigid in enforcing the rules. And now for the penalty."

"Is there to be a penalty?" asked John.

"Yes," said his mother. "A rule is nothing without a penalty. It is no law, only a recommendation. I expect to have some difficulty in establishing these rules, for of course you will violate them, and then I shall have to insist on the penalty; and that will be very unpleasant both to you and to me."

"It will be unpleasant for us," said John, "if it is much of a punishment; but I should not think it would be unpleasant for you."

"Yes, indeed," said Mrs Gay, "it will be very unpleasant for me. I shall have a very strong desire to let you off from the penalty, but I shall know that if I do so I shall break down my rule."

"But what is the penalty to be?" asked John.

"Ah!" said his mother, "that is a question that we must decide upon. We might either have it a part of your salary to be stopped, or that you were not to do any more about the drawers for so many days."

After some consultation on this point, it was finally decided that the penalty for breaking either of the rules should be a fine to be paid out of the salary. The fine was to be a penny for each offence on the part of John, and a halfpenny for Benny.

"And you must remember now," said Mrs Gay, "that you must submit to your punishment good-naturedly, and give up the money without offering any objections, or making any complaints, when you break the rules."

"Yes, mother, we will," said John. "But I don't think that I shall lose any money, for I am determined not to break the rules at all."

"You *will* break them, you may depend," said his mother. "Indeed, I am so certain that you will not remember to keep them until you have suffered the penalty two or three times, that the sooner you begin the breaking them the better I shall be pleased."

I think the view of the subject which Mrs Gay thus took was a correct one. A law is never really established in its full force until it has been broken and the breakers of it punished, so as to make people feel that it is *law*, and not merely advice or recommendation. Parents often make rules, expecting, or at least hoping, that the mere making and announcing of them will be sufficient. But this is a great mistake. The celebrated emperor Napoleon the First used to say, that he never considered a city which he had taken as fully in his power, until there had been at least one insurrection in it against his authority, which his soldiers had put down. And so a mother who makes a rule with a penalty ought not to consider her work in respect to it completed, until at least one breach of it has occurred, and been properly punished. Then, and not till then, will her children understand that the rule in question is *law.*

At noon on the day of this conversation, at breakfast, when the boys were ready to begin their work, they put on their coats and caps, and went first down to the cellar, from thence to the store-room, and finally to a sort of lumber-room which opened out from the corner of the shed, to see if they could not find some clean and smooth box, which they might knock to pieces, to obtain short boards for floor and furniture protectors. They found two or three boxes, either of which would have answered very well. They fixed upon one, which they knocked to pieces, taking great care not to split the boards. They then knocked all the nails out. Thus they had two side-pieces, two end-pieces, and the bottom.

"Now," said John, "the bottom is not good for much, for it is cracked, but there are two good sides and two good ends, all smooth and nice. I will have one of the sides and one of the ends, and you shall have the others."

"They are nice smooth boards," said Benny, "and very light, only I wish we could get the nail-holes out."

"I can saw them off," said John; "and I will. If I could only find something for a straight-edge to mark by."

"What do you mean by that?" asked Benny.

"Why, a kind of a ruler," said John. "The carpenters always call anything they rule by a straight-edge."

"What do you want to mark it for?" asked Benny.

"So as to go straight and square across the board," said John. "If I saw it slanting or crooked, then our boards will not be square."

Benny thought that John could saw it straight enough without marking. He could guess, he said; but John replied that in carpenters' work there must be no guessing.

"We must always measure and mark," said he.

"'Measure and mark,
Or you'll work in the dark.'

That's Ebenezer's proverb."

So John measured off the same distance from each end of each of the side-boards by means of a small stick, and marked the places with the point of a nail. Then taking one of the pieces of the bottom for a straight-edge,—for the bottom had come apart in the middle, but the outer edge of each part was pretty straight,—he marked the lines which he was to follow in the sawing.

He then took one of the boards to a strong stool which was standing near the great open doors of the shed, and proceeded to saw off the ends of the board where the nail-holes were. While he was doing this with one of the boards, Benny brought him the others, and in a short time the sawing of all the four ends of the side-boards was done. The end-boards, which were square, did not need sawing, for the nails had been driven into the edges of these, and thus did not disfigure them much.

"And if we only had a little putty to fill them up," said John, "that would hide them entirely. I can get putty enough to fill all these holes for a penny, and I will get some with my next money."

The boys took their boards, each one his own, and carried them into the house.

Each boy had thus a long board and a square one, and they proposed to use the long boards for work on the floor, and the square ones for the table. They afterwards found another use for the long ones, which proved to be a great convenience, and that was for seats. They used to pull the drawer of the chest-bureau in the back hall entirely out upon the floor, and then place their long boards across the two ends of it. This made two very good seats, one for Benny at one end of the drawer, and one for John at the other end, with room on the seat, at one side, to put tools or work upon.

Then when the boys had done their work, and were ready to put their things away, they used to turn these boards lengthwise of the drawer, and so lay them in it; for though they were long enough to pass across the drawer from side to side, and rest on the edges, yet when they were turned the other way they would lie in it very easily, with plenty of room to spare all around.

The square boards they employed to lay upon the table, when they wished to use the table, in order to protect the surface of it from being scratched or injured in any way by their work or by their tools. And in order to make the protection more complete, by preventing the board itself from rubbing too hard upon the polish, their mother fastened some pieces of cloth upon the four corners of each piece on the under side. She fastened these pieces on by means of a little glue which she dissolved in a mug, placed carefully before the fire.

"And now," said Mrs Gay, when all these preparations were complete, "if you work upon the floor or upon any of my tables without these protectors, or if, when you go away after you have finished your work any day, I can find in the hall or in the sitting-room any signs of your having been there at work, then you will have to submit to the penalty. I advise you to imagine that you are two mice that have been nibbling, and that unless you take away and hide every single crumb that you have made, the cat will find you out and come and catch you."

"Now," said John, when he and Benny first sat down to their work, "I have got to see whether I can make a parallelopipedon."

"A what?" said Benny.

"A parallelopipedon,' replied John, "a rectangular parallelopipedon."

This extremely scientific term Ebenezer had found in one of his books of carpentry. It is a body which has its opposite sides exactly parallel, —that is, which has all its sides exactly of the same breadth in every part, without widening or narrowing in any direction. And when, besides this, all the corners and edges are exactly *square*, then it is called a square-edged parallelopipedon, or, more scientifically, a rectangular parallelopipedon.

It is no matter what the shape of a block of wood, for example, may be in other respects. If the sides are parallel, and all the edges and corners square, it is a rectangular parallelopipedon.

Thus a long board, if the ends are sawed off square and true, and if it is of the same breadth and thickness throughout, is a rectangular parallelopipedon. So is a small square block, or one shaped like a brick.

The dice which are used in playing backgammon are rectangular parallelopipedons; and the sides of boxes, provided the boxes are of the same width at top and bottom.

If you take any block of wood, square at the sides and at the ends, and examine it, you will understand all this very plainly.

"Now," said John, "I have got to find a board for the bottom of my nail-box, and then I have got to make two parallelopipedons for the sides, and then two more for the ends."

A great part of the work which carpenters have to do consists in getting out pieces of wood of exactly the same length, breadth, and thickness throughout; in other words, making parallelopipedons. And that is the reason why I have taken so much pains here to explain what the nature and properties of a parallelopipedon are. For the more correct and exact a boy's ideas are of such a geometrical form as this, the more likely he will be to succeed in the work which he undertakes.

Now the usual method which carpenters and cabinetmakers adopt in forming their parallelopipedons, is by means of a square, a saw, a gauge, and a plane. But John had none of these tools, nor had he any bench or other facilities for working with them if he had had them, nor the necessary skill to use them, if he had the facilities. So Ebenezer had explained to him another mode of shaping his pieces of wood, and in accordance with the instructions which Ebenezer had given him, he proceeded in the manner I am now to describe.

Just as he was ready to begin, he saw that Benny had seated himself upon the floor, with his long protecting board before him, and a piece of wood upon it, and was beginuing to bore some holes.

"What are you going to make, John?" said Benny.

"A nail-box," said John, "to keep brads and tacks in."

"If that is what it is for," said Benny, "you ought to call it a brad-and-tack box."

"True," said John, "but that is of no consequence. I am going to have some partitions in it, and perhaps I shall keep small nails in one of the compartments."

John's plan was to have a shallow box—the sides to be only about an inch high—because he did not wish to have compartments too deep, for convenience in reaching the nails.

He selected a small piece of wood from among those which he had procured at the cabinet-maker's for the bottom of the box; for as the precise size of the box was not material, he wisely determined to save himself some work by taking a piece for the bottom already made. The piece which he chose was about six inches long and four wide. Then he took another piece of wood, large enough to make the sides. He marked out the precise length of the bottom of the box upon this wood. He concluded to have his box an inch deep, less the thickness of the bottom, and so he proceeded to mark on the wood with a ruler and a pencil two strips an inch wide at both ends. Then with the sharp point of his knife he cut a line along the pencil-marks, first very lightly, and then going over it again and again, he cut deeper and deeper each time, until he had cut nearly half through the wood.

He then turned the board over, and after marking it carefully across the ends, so as to find the exact place on the other side, he cut again on that side; and, after making two or three strokes with his knife, he found that he could break the strip off very easily. He cut the second strip in the same way.

The strips which he had cut were of the right width, but they were too long, and the next thing was to cut them to the proper length. John could mark the length very easily from the length of the bottom of the box. But it was necessary not only to have the length right, but also to have the ends cut off square. To do this, Ebenezer had told him, that as he had no carpenter's square, he must make a square by means of a sheet of paper.

"If you fold a pretty large piece of paper," said he, "first in half, and then again in quarter, and take pains to bring the two edges formed by the first fold exactly together, you will make a very accurate square corner, or *right angle*, as the carpenter's call it."

John made his square corner in this way, and laying it down upon his strips he marked the cross lines by it in the proper places, and then cut them through, first half on one side, and then the other half on the other side, as he had done with the long lines.

It was harder to cut across the grain, of course, than lengthwise with it; but John succeeded in doing it, and thus the two sides of the box were cut out "in the rough," as the carpenters term it.

I say in the rough, for though John had marked out the dimensions of the pieces as accurately as he could, still when they were cut out they were not perfectly smooth and true, for it is impossible in such cases to make the cutting on one side correspond pecisely with that on the other. And now the finishing them with sand-paper was to come into play.

For this purpose John put his protecting board on the table, and then laid the sand-paper down upon the board, with the rough side up. He then took the two pieces which he had cut out, and holding them together side by side he began rubbing the lower edges of them upon the paper, taking great care to hold them perfectly upright, and to carry them along to and fro in a perfectly level position, without *rocking* them in the least either from side to side or from front to back. In this way he soon wore down the lower edges of the pieces, so as to make them very smooth and true.

He then did the same with the other sides, until he had made them smooth too. Then he had two strips with the edges finished, but it was not yet certain that they were exactly of the same width throughout their length, as it is plain they ought to be. It is true he had measured them as correctly as he could, and marked them carefully before he began to cut. But there will always be some inaccuracy in such measuring, and then the knife in cutting will deviate more or less from the true line.

You would think that he would now measure again to see if they were just as wide at one end as at the other; but there is a simpler way of doing it, and that is by turning one of the pieces end for end, and applying them to each other again in that reversed position.

If now in such a case there should be any difference in the two ends, the broad end of each will in this second position of the pieces come opposite to the narrow end of the other, and the difference, if there is any, however slight it may be, will be immediately apparent, and may at once be worn away by rubbing them again upon the sand-paper.

By following this process John succeeded in a short time in making the sides of his pieces even and true, and the pieces themselves of the same breadth at each end and throughout their whole length. He then finished the *ends* of the pieces in much the same way.

"There!" said John, surveying his work with great apparent satisfaction—"finished."

"What is finished?" asked Benny, "your nail-box?"

"No," said John; "only the two parallelopipedons for the two sides. See!"

So saying, he handed the two pieces of wood which he had shaped to Benny to examine. They were indeed nothing but two plain pieces of wood, but they were so smooth and square and true, and they were so exactly alike when placed together either way, that it was quite a pleasure to look at them.

"And now," said John, "we are going to put our work away."

Benny was at first unwilling to do this, being still interested in his boring, and he asked John why he did not go on and finish his nail-box. But John had been recommended by Ebenezer not to work too long at a time.

"As a general rule, said Ebenezer, "you had better only undertake and finish one operation on your work at one time. Don't think at all, while you are making a thing, of the time when you will get it done, for that will only make you impatient to see it finished; then you will hurry your work and make mistakes and do it badly; and so you will get vexed and worried, and all the pleasure will be spoiled. The best way is, when you begin to work at any time, to undertake for that day only one single operation, and take time to do that well; and when you have done it, lay by your work for that day, and go and amuse yourself with something else. Then you will not get tired and worried, and your work in the end will be much better done."

In accordance with this counsel, John set himself for his task that day to make the two side-pieces only for his nail-box, and having now finished them, he decided to put his work away.

"And we will brush up every particle of the borings and dust," said he, "so that they cannot possibly find out that the mice have been here."

So he went into the kitchen and brought the dust-pan and a little broom. He set Benny at work to do the first sweeping, while he put his work and the boards into the drawer. Then he himself gave the table and the carpet a second sweeping; and finally, after emptying the dust-pan, he came back and gave them a third, and then he and Benny examined the carpet and the table in every part to see if there was the least trace of their having been at work there left in view.

When they were fully satisfied that all was right, they put on their coats and caps and went out to slide.

That evening at supper the boys asked their mother whether she found any traces of their work in the back hall.

"I have not looked," said Mrs Gay, "but I have no doubt as to how I should find things if I should look."

"How?" asked John.

"All perfectly right," said his mother. "There is no danger but that you will put everything in nice order for a while; and so I shall not think of looking to see whether you have broken the rule for some time to come. You will be very careful no doubt for some time; but at length, when you have become very much interested in your work, and have forgotten a little about the rules, *then* will come the time for me to catch you and call for the penalty."

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CHAPTER IV.

THE NAIL-BOX.

JOHN made a very serious mistake at first while going on with his mechanical operations, in respect to the mode of managing his brother Benny. His mistake arose not from any disposition to neglect his duty to his brother, under the agreement which he had made with his mother to act as his special friend and protector, but rather from an excessive desire to fulfil his duty in the most faithful manner.

He wished very much to teach Benny all that he himself had been taught by Ebenezer, and to have Benny learn to do all that he was learning to do himself. But Benny was not old enough to do this. He was only old enough to learn how to use his hands and arms, how to strike blows, and to turn a borer round and round, and to be amused with the splitting of a piece of wood and other similar things, which, though they are of no special interest to a boy of John's age, are very amusing to one of Benny's. In a word, all that he was yet prepared to learn was mainly the use and command of his muscles, while the work that John was doing—which implied a close observation of form and of magnitude, and a careful comparison of similar things in order to detect slight differences between them—was work for the mind and the brain; and Benny's mind and brain were not yet sufficiently developed for such operations.

John did not think of this, or rather he was not aware of it at all, and for several days he tried in vain to induce Benny to work to some purpose. At last he became quite out of patience, and he told his mother one evening, after Benny had gone to bed, that he could not do anything with him.

"He won't take any pains at all," said he. "He won't do anything but bore and pound at random; and he is not learning anything, and I can't make him. He turns it all into fun. I don't think I half earn the money you pay me for teaching him."

"But I don't pay you for *teaching* him," said his mother, "but only for keeping him amused and occupied, and that you do very well. You must not try to teach him what *you* are learning. He is not old enough for that. He is only old enough to learn more perfectly to use his hands and arms. So let him do just what he pleases."

"But he wastes the wood and the nails," said John, "by driving the nails in every way, and without doing any good at all."

"Never mind that," said his mother. "You can get plenty more blocks of wood from Ebenezer's shop; and as to nails, I can buy for sixpence enough to last him a week. And it is certainly worth a penny a day to have him amused and occupied in working with you.

"Besides," added his mother, "you can get back the nails he drives into the blocks by burning the blocks on the shovel in the kitchen-fire. Then the nails will be all left on the shovel, and when they are cool they will be as good as they were before."

"We *can* do that," said John; "I did not think of that."

"So you must not trouble yourself about teaching him any carpentry," continued Mrs Gay. "Learn as much yourself as you can, but let Benny turn it all into fun. Indeed, the more he turns it into fun the better; so you must help him to make as much fun out of his work as you can."

This conversation presented the subject of Benny's carpentry to John in a new light; and he determined at once to follow his mother's advice.

Accordingly, when he and Benny next went to work in their shop, as they called it, and Benny wanted a block and some nails to drive into it, John said he would give him some, and he advised him to play at building a house.

"Only," said he, "I must go and get a rag and some thread, and have it all ready."

"For what?" said Benny.

"To tie up your fingers when you pound them with your hammer," said John.

"But I am not going to pound my fingers," said Benny.

"Ah, yes," said John. "I am going to let you have a great many nails to play at building a house, and when boys have a great many nails to drive, they always sooner or later hit their fingers, even if they are as big boys as you.

"Besides," he added, "even grown men almost always have some accident in building a house; so you must expect one. But I will get a rag and have it all ready."

So John went and got a rag, and a thread to tie it with, and laid it out with great ceremony upon the table.

But Benny said it was of no use, for he was positively determined that he would not pound his fingers.

John then went to work making two parallelopipedons for the ends of his box. Ebenezer had told him that he had better make the end-pieces of exactly the right breadth, but not to cut them off to the length until they were nailed on. It will be plain to the reader, on a little reflection, that these end-pieces were to be longer than the ends of the bottom of the box were, for they were to extend beyond the ends of the side-pieces also. Now it would be somewhat difficult and troublesome to ascertain by measuring beforehand exactly what this length should be. It would be made up, it is true, of the length of the end of the bottom-piece, and of the thickness of the two side-pieces, but it would be somewhat troublesome to place these parts together and measure the whole distance.

Therefore it would be better, Ebenezer said, to make the end-pieces a little too long; and then, after they were nailed on, to trim off the excess carefully with a sharp knife.

"A broad chisel would be a great deal better," said he, "if you only had a chisel. The very first valuable tool that you buy must be a pretty broad chisel."

So John proceeded to the work of getting out the end-pieces of the proper width, while Benny went on driving the nails.

"The way that boys pound their fingers," said John, "is this. They try to make a nail stick in the wood a little, so as to stand up by itself while they hammer it; but sometimes it won't stand up, and so they have to hold it, and in this way, when they try to hammer the nail, they hit their fingers. If they would always first bore a little hole with the gimlet to put the point of the nail in, and so make it stand up itself, there would not be so much danger of their hitting their fingers in *this* way."

"I am going to bore a hole first for all my nails," said Benny.

"But then," continued John, "there is another way that boys hit their fingers, and that is by not taking their left hand away far enough when they begin to strike hard blows on the nail, and in this way they hurt themselves dreadfully. This is the way Bill Booby did."

"Who was Bill Booby?" asked Benny.

"He was a boy that Ebenezer told me about," said John. "One day he was driving little nails, like you, into a board which he had upon the floor, and after he had set a nail into its hole, he put his left hand down upon the board, quite near to the nail. Then he began to hammer the nail in. But the nail would not go in straight, because he had not bored the hole straight. So he got in a passion, and struck with his hammer at the nail as hard as he could, but instead of hitting the nail he hit his own thumb, and hurt himself dreadfully."

"Did he cry?" asked Benny.

"Cry!" repeated John. "He made such an uproar that he aroused the whole house. They had to put a poultice on his thumb, and when they took it off they found that the nail had turned all black; and finally the nail came off, though afterward a new one grew out in its place."

Benny paused from his work, and looked up with earnest attention while John was relating this story.

"But he learned two good lessons from this accident," said John.

"What two lessons?" asked Benny.

"The first was," said John, "that when a boy is driving nails, he must take care to keep his spare hand out of the way. And the second was, that he must not get in a passion with his work when it happens to go wrong."

Benny then proceeded with his work, but John observed that he was exceedingly careful in respect to hitting his fingers. For a time, in fact, while he was driving in a nail, he put his left hand away behind him. After a time, however, finding it somewhat inconvenient to hold one hand behind his back while he was driving with the other, he relaxed this excessive caution, and only removed the spare hand to a safe distance from the hammer.

As soon as John had finished his two side and two end pieces, he was ready to nail the box together. But here he came upon an unexpected difficulty. He had no boring instrument to bore the holes with which was of the proper size for such small brads. His brad-awl, and even Benny's gimlet, were both too large.

His first idea was to take Benny's gimlet—although it was decidedly too large—and try to "make it do." But Ebenezer had told him that there was nothing so bad for a young workman as trying to "make things do;"—that is to say, trying to use tools and implements for purposes that they were not intended for, and of course not adapted to.

"It takes a very good workman," said he, "to work with poor or unsuitable tools; and the reason why boys so often get discouraged and out of patience in attempting mechanical operations, and spoil their work, and damage their temper, is because they try to do something with a tool which is not intended for it, or with one that is dull or out of order. If your tool is not sharp, don't try to 'make it do,' but wait until you have sharpened it; and if you have not got the right tool, wait till you can get it."

"But perhaps it is a tool that I can't get at at all," said John.

"Then you ought not to attempt that piece of work," replied Ebenezer. "Never begin any piece of work until you have carefully considered whether you have the proper materials, tools, and implements to go through with it in a regular and workmanlike manner."

So John determined not to nail his box together until he had procured a brad-awl of exactly the right size for his brads; and as he had money enough to buy one, he determined that he would go to town and get one the next day; for it was too late for him to go that afternoon.

Benny was now beginning to be satisfied with nailing, and John thought that it was time for him to form his plan for recovering the nails which Benny had used.

If now he had stated seriously to Benny that he did not wish to have all those nails wasted, and so was going to take them to the kitchen-fire and burn them all out again, Benny would perhaps have objected to having all his work spoiled; and so, on the principle which his mother had recommended of turning all that he had to do with

Benny as much as possible into fun, he proposed to him that after they had put their work away they should take his house out to the kitchen, and play that it took fire and burned up.

Benny was much pleased with this idea, and John showed him how to nail one or two narrow strips across from one of his blocks to another, so that they would stand up and form some rude resemblance to a house. The strips that went across he called the beams.

Then they went into the kitchen, carrying with them the house which was to be burned, and also a number of little bits of wood and cuttings which John had made in his work, and had reserved for this purpose.

"These are for the furniture of the house," said he.

"Let *me* carry the furniture," said Benny.

So John gave Benny the furniture, and together they went into the kitchen. There John placed the house upon the large kitchen shovel, and Benny proceeded to put the furniture in. They then placed the whole in the corner, so that the smoke from the burning building might go up the chimney instead of coming out into the room.

He then gave Benny a long, slender stick, in order that he might light one end of it and so set the house on fire. The pretended furniture served as kindling wood, and the blocks themselves being dry and very combustible, notwithstanding the great amount of iron there was in them, the whole was soon all in a blaze, and the result was quite a conflagration. Benny was in an ecstasy of delight when he found that the beams themselves had taken fire and were blazing like the rest.

After a while the house was all burned to ashes. John then blew the ashes away with a pair of bellows, and carried the hot nails on the shovel and let them slide off into a basin of water to cool them. He thought it would harden them, too, supposing that by heating them the temper had been taken out, and that cooling them suddenly would harden them again.

He was, however, mistaken in this, for the nails were made of iron, and not of steel, and it is only steel that is hardened by being suddenly cooled. Nails are somewhat softened, it is true, by being heated, but this is on a different principle from the softening of steel by taking the temper out, and the hardness is not restored by plunging them in cold water.

At any rate John recovered nearly all Benny's nails, and after pouring the water off from the basin and letting the nails dry, he carried them back and put them by themselves in one of the drawers, all ready for Benny to use again.

John was relieved of the difficulty he was in in respect to a brad-awl of the proper size for the brads with which he was going to nail his box together, sooner than he expected, for that evening his uncle Edward called to see him, and made him a brad-awl.

This Edward, although he was really John's uncle, was a very young man, being not more than eighteen or nineteen years old; but he was a very ingenious youth, and he took great interest in all John's occupations and amusements; so when John showed him the pieces that he had shaped for his nail-box, and told him that he was waiting to buy a small brad-awl to nail them together, he told him that he would make him a brad-awl.

"It is a very easy thing to make a brad-awl," said he, "that is, provided you can get a big needle."

"How big?" asked John.

"Why, as big as you want your hole to be," said Edward.

John immediately went to his mother, and she gave him two or three pretty large needles. There was one—a darning-needle—which Edward said was of about the right size.

"That will do," said he; "and now the first thing is to make the handle."

So he looked in John's drawers and selected a long piece of wood, which was nearly square, and of about the right size for the proposed handle.

With this stick he went with John and Benny into the kitchen; and there, taking out his knife, which was very sharp, and in perfect order in all respects, he proceeded to fashion one end of it in the shape of a handle.

"First," said he, "we make it square."

So he proceeded to cut away the four sides of the wood near one end, until he had made it as nearly square as possible, at the same time making it taper toward the end. He examined the four sides repeatedly as he proceeded with the work, to see if they were exactly equal in breadth, and if the corners or edges where two of the sides came together were exactly square. Now and then he gave the stick to John in order that he, too, might examine it in respect to these points, and give his judgment upon them. This gave John an excellent lesson, by calling out his powers of observation, and cultivating his ideas of accuracy in respect to magnitude and form.

"Now," said Edward, "we must shave off all the corners, and make it eight-sided."

So he proceeded to do this. He shaved off the four edges, taking care to cut each one away just enough to make the new faces which he thus formed exactly equal to what remained of the old ones.

In shaving down these corners or edges in this way, Edward drew the wood along over his knee, holding his knife over it, with the edge in the proper position for cutting into the wood to the right depth. Boys very often use this mode for shaving down a long stick in an even and uniform manner, only Edward took care first to place a small piece of cloth over his knee to protect his trousers,—a precaution which boys in such cases very often neglect.

"A chisel would be better for this work than a knife," said Edward; "if you only had a chisel."

"Better than a knife?" asked John.

"Yes," said Edward; "the chisel is the carpenter's knife. You can cut more smoothly and uniformly with a chisel, after you have once become a little accustomed to it. The next tool that you buy, I advise you to choose a good broad chisel. You push it along over a stick like this, and the back of it, which is flat and smooth, serves as a guide, and keeps the edge from dipping in or turning out, as a knife is very apt to do."

By this time Edward had brought the stick pretty exactly to an octagonal—that is, to an eight-sided form. There were four sides to it originally when it was a square, and by shaving off all the four angles he had made four sides more. This made eight.

"Now," said Edward, "look at this stick and examine it carefully, and see if there is any difference between the different sides."

So John took the stick and began to examine it. He found one side which near one end of it was a little broader than the adjoining sides. Then Edward shaved away one of the adjoining sides which seemed a little too narrow, until he had rectified the error.

"Now I will shave off all these eight angles," said Edward, "and then I shall have sixteen sides and sixteen angles, and then I will shave off the sixteen angles and that will give me thirty-two sides; and thirty-two sides makes it round."

"Really round?" asked John.

"No, not really round," replied Edward, "but it will be so near to it that sand-paper will finish it. Thirty-two sides are as far as we can go with a knife or a chisel."

Edward said that there ought to be a ferule on the end of the handle, to prevent the wood from splitting when the shank of the tool was driven in, or by the force of the workman in boring with it.

"I wish I had a ring or a band of some kind," said he, "to put on this handle. You had better save all the ferules that come off from old canes and umbrellas, to cut up and put on your tool-handles."

John said he had some rings among his play-things, and he went to find them. Presently he returned with two or three, one of which Edward said would do very well.

So Edward fitted this ring upon the end of the stick where the taper terminated, and then cut it off of the proper length, rounded the end, and finally sand-papered the whole with a piece of sand-paper which John brought him,—and the handle was done.

"Now," said Edward, "so much for the handle. The next thing is the awl."

So Edward took the needle which he had selected for the awl, and began to examine it attentively.

"We can't have any shoulder to it," said he, "to prevent its being crowded too far into the handle, but that is not very important for so small an awl. In every other respect we can make it all right.

"And the first thing to do is to square the shank, so as to prevent it from *turning* in the handle. There are two ways of doing it," said Edward. "I might grind the two sides of the needle flat where it is to go into the handle, or I might hammer that part flat."

"You can't hammer it," said John. "If you strike a needle with a hammer it will break it, it is so brittle."

"Ah," said Edward, "we must take the temper out first."

So saying, Edward took hold of the needle with the tongs, and held it in the burning coals under the fire until it became red-hot. Then he took it out and laid it down upon the hearth, and let it cool slowly. While it was cooling he got a flat-iron, which he was going to use for an anvil, and holding it between his knees with the *end* up, he placed the needle upon it, taking hold himself of the eye-end, and proceeded to hammer it, from the middle toward the point, until it was somewhat flattened.

"Stop," said John, when he saw him ready to begin, "you are flattening the point. You want to flatten the part that is to go into the handle."

"That is the part which is to go into the handle," said Edward.

John had supposed that the point was to be used in some way for boring; but he was mistaken in this; for the needle, toward the point, tapers gradually all the way to the end, which renders it wholly unsuitable to serve for the boring part; since if the tip were formed at any place in this tapering part by grinding off the steel on each side so as to give it an edge, it would not bore well, for as the stem of the needle would gradually enlarge from the tip, the hole made by the cutting edge would not be large enough to allow the portion that followed to enter the hole easily, and so it would soon become wedged and stop the boring.

It is better therefore to use the point of the needle as the part to be *flattened* and go into the handle, and to make the cutting edge at the other end, at the part where the needle widens a little just at the eye, which is exactly the form that is wanted.

When Edward had flattened the pointed end of the needle sufficiently, he drove it into the handle as far as it ought to go, taking care to examine it carefully from time to time as it entered, to see if it was going straight.

When it was in, he drew it out again with a pair of nippers, and broke off the point.

"What is that for?" asked John.

"To prevent its going in any farther," said Edward. "I kept the point to help me to make the hole in the wood as far as I wished it to go in, but now I break it off to make it hard, so that it may not go in any farther. We ought to have a shoulder; but that we can't make."

Having broken off the point of the needle, Edward then drove it in again as far as it had been before, and there it remained very firm. Then with the nippers he broke off the tip of the other end at the eye, leaving a small portion of the widened part just below the eye, for the cutting part.

"Now is it done?" asked John.

"All but grinding it sharp," said Edward. "You could bore pretty well with it now in soft wood, but it will be better to grind it. But that will be a dreadful job. We shall have to take a candle and go out to the grindstone in the shed, cold as it is, and stay there till we grind it."

"How long will it take?" asked John.

"About half a minute," said Edward. "No, a quarter of a minute. One, two, three, four, five, —about as long as that for each side."

"Well," said John, eagerly, "I'll get some water."

"We don't need any water," said Edward, "and it would not do us any good if we had it; for water would freeze on the grindstone as fast as we should put it on."

"But it will take the temper out," said John, "to grind it without water."

"The temper is out already," said Edward. "We took it out when we heated the needle in the fire. It is as soft as it can be now, and grinding it on a dry stone won't soften it any more. But I can easily harden it again when it is ground."

"Then we will go and grind it," said John.

"Yes," said Edward. "There are three of us—just enough for the work. Benny shall hold the lamp, you shall turn the stone, and I will grind the tool."

Edward accordingly took the lamp, and holding it in one hand and the new brad-awl in the other, and followed by the two boys, went out through the back-door to a closed shed, where the grindstone was kept, near a window. It was very cold, and the sharped stinging air nipped the boys' ears and noses and made them shiver. The windows which they passed were all frosted over with stars, and spangles, and plumes, of every conceivable form.

Edward, when he reached the grindstone, sat down upon a seat that was fixed against the wall, on purpose for the grinder to sit upon.

"Now, boys," said he, speaking in a prompt tone of voice, "bear a hand and let us do this job promptly. Turn John, and Benny hold the lamp. Come close by. Hold it so that you can see yourself, and then I can see.

"There!" said he, after the stone had gone round four or five times,—"one side is ground," —then, after a moment's pause, again added,—

"There! both sides are ground." Then rising suddenly and taking the lamp from Benny's hand, he said,—

"Now we will see who will get back to the kitchen-fire first."

So with a bound and scramble they all rushed back into the kitchen. Edward, though he pretended to be making all possible haste, managed to hold back a little, so as to let the two boys go in before him. John ought to have done the same in respect to Benny, but he was not so considerate. He crowded by Benny, pushing him somewhat aside, and got in first. Benny of course, being so much smaller and weaker, had no chance against him.

It is all very well for big boys to run races, and playfully make trials of strength with little boys; but if they have any manliness in them, they will always manage to let the little boys beat them in the end.

When the boys had returned to the kitchen-fire and had warmed themselves a little, Edward examined the edge of the brad-awl, which he had formed upon the stone, and said it was all right.

"You might touch it upon an oil-stone," said he, "to make the edge a little sharper, but it will bore very well as it is, as soon as I get it hardened."

"I have not got any oil-stone," said John.

"You ought to have one," said Edward. "You can buy a small one—a slip, as they call it—and set it in a block of wood yourself."

John was quite pleased with this idea, and would have made further inquiries, but his attention was now at once taken up by Edward's arrangements for tempering the brad-awl.

"First I must harden the steel," said Edward, "and then temper it."

"I thought that tempering it was hardening it," said John.

"No," replied Edward, "not exactly."

He then went on to explain that by plunging steel into cold water when it was red-hot it was made extremely hard and brittle. It was used in this state for files, and for some other purposes, but not for edged tools. An edge of this excessively hard steel would not stand, but would break away in cutting any very hard wood, and become jagged and dull.

So it is necessary to diminish this excessive hardness, or, as they call it, *temper* it,—tempering meaning simply to *moderate.* Thus temperate weather is moderate weather, and the temperature of the air is the state of moderation it is in in respect to cold. So a good-tempered boy is a boy whose passions are moderated and kept under control. It is true, we sometimes speak of *temper* simply, in a child, when we mean the indulgence of bad passion; but we always mean bad temper in such cases, though we omit the word bad.

Edward held the point of the brad-awl in the lamp until it became red-hot, and then plunged it suddenly in cold water. This made the point extremely hard and brittle. It was only the point, and a portion of the steel at a short distance from the point, that he heated and hardened in this way. It was preferable to have the rest of the stem of the brad-awl left soft and flexible, for it would be better to have it bend a little rather than break, if by chance it should be strained too hard at any time in boring.

The heating of the point of the awl and plunging it in water, made the bright part, where it had been ground, black again. This was owing to a thin film of what is called *oxide*, which forms from the air upon the surface of iron or steel when it is heated.

The colour of the film which is thus formed varies according to the degree of heat. First it is a light straw-colour, then brown, then as the heat goes on increasing, it becomes purple, and deep blue, and finally black. In tempering tools, the workman heats them gradually, after they have been hardened, in order to "draw the temper," as he calls it; that is, to moderate the excessive hardness and brittleness.

He draws the temper more or less, according to the nature of the different tools that he is making, and the different purposes and uses that they are intended for; and he judges of the degree of heat by the colour which the steel assumes. Thus straw-colour denotes the temper for one kind of tool, brown for another, and blue for another. He heats his tool in the lamp, or in the fire, and sometimes in an iron basin filled with very hot sand over a stove or furnace; and when it comes to the right colour, that is, when the brittleness has been sufficiently tempered for his purpose, he plunges it into cold water.

If the tool is tempered down too low, then it becomes soft and flexible, and the edge will bend over when you attempt to cut with it. If it is not drawn down enough, then it is brittle, and the edge will break away like an edge of glass. But between this brittleness on the one side and flexibility on the other, there is a mean in which the two qualities are combined, and what we call toughness is the result, and this makes the right temper for most tools.

Edward, after examining the awl a moment, asked a girl named Bridget, who was sitting by the fireside knitting, if she would let him have her bath-brick—the one which she used in scouring her knives. So Benny brought him the brick out from a closet near.

"What are you going to do?" asked John. "Are you going to sharpen it?"

"No," said Edward, "I am going to brighten it a little on one side, so that I can see the colour as I heat it."

So Edward began to rub the awl carefully upon the brick, just as if the brick had been a whetstone and he was going to sharpen it. While he was doing this he explained to John that when he heated the awl and plunged it into cold water to harden it, it made the surface all black by forming a coat of oxide upon it from the air, and that he was now wearing this film off, so as to brighten the steel again, in order that he might see the colour when he came to temper it.

As soon as he had made it bright he held the point of the awl in the flame of the lamp, watching the bright part intently all the time, to observe the change of colour. Benny crowded his head up near to see too. John stood by with a cup of water, all ready for Edward to plunge the brad-awl into, as soon as he should find that it had attained the proper colour.

The operation succeeded perfectly well. As soon as Edward saw that the straw-colour began to appear, he dipped the tip of the awl into the water. It made a slight hissing sound, but was cooled almost immediately.

"There," said Edward, "now get a block of wood and see if the brad-awl will bore."

"Is it done?" asked John.

"Yes," said Edward, "all but oiling or varnishing the handle. If you had some oil it would be a good plan to oil the handle. It would make it look brighter, and it would keep cleaner and nicer."

"Well," said John, "Bridget can get us some oil."

"Ah, that kind of oil won't do," said Edward. "Any kind of oil that Bridget has got would only make the handle greasy. You must have a *drying* oil,—such as painter's use."

There are some kinds of oils which harden and dry when exposed to the air, and this is the proper kind to put upon wood in such cases as this. The kind most suitable is what is called boiled linseed oil. You can get it at any painter's. When it is put upon wood it fills up all the pores near the surface, and hardens there, and so covers the surface all over with a thin coating like a varnish, and tends to make the wood keep bright and clean.

John said he was determined to get some boiled linseed oil the very next day, and oil his brad-awl handle.

The boys all went back into the sitting-room, and here John tried his new brad-awl and found that he could bore with it very well. A boy can make very good awls in this way out of large or small needles, and can make the handles too himself, as Edward did in this case, though to make a good one requires some time, patience, and care. Such awls are indeed not so good as those you buy, for they have no shoulder, and so are apt to crowd into the handle in using them, if you attempt to bore into very hard wood. But with careful usage, and wood not too hard, they will answer very well.

Edward recommended to John to make some needle brad-awls, and also to make some handles for various tools. He told him that he might easily make handles for his files.

"And you will want one or two files very soon," said he, "especially a coarse, flat file, and a fine rasp for wood."

For rounding off the ends of his handle a fine rasp or a coarse file, he said, would be exactly the thing. After cutting it out in nearly the right shape with his knife, he could finish rounding it with a rasp or file better than with any other tool.

"The next money you have," said Edward, "buy a fine rasp, round on one side and flat on the other, and also a coarse file, flat on both sides; and there will be two handles for you to make. Then you can buy a set of brad-awls of various sizes, beginning with the needle-size, and so on up to the largest, and make handles for them. You can buy the awls for very little, if you buy them without handles. So that with little money you can have a set of tools by which you can make any kind of hole you want, up to the biggest that can be made with a brad-awl."

On hearing this John determined that his next work should be to make two or three small brad-awls out of needles, and to make handles for them, and also to buy four or five others, from the largest of the needle-awls upwards, and make handles for them, so as to have a complete set.

"I mean to have the handles all exactly alike," said John.

"No," replied Edward. "It will be better for them to increase in size regularly as the awls themselves do. It is better to have the handles of tools different, than to have them alike. Then they catch the eye quicker, and you can the more readily get the one that you want."

The only difficulty was about ferules. To make a handle complete it is necessary to have a ferule—that is a small brass or iron band—around the end of it where the tool is inserted. Edward told John that the long ferules that come upon the ends of umbrellas were excellent for this purpose. One of them he said could be easily cut up into four or five, suitable for tool-handles; and as they are always made quite tapering, the parts cut off would be of different sizes, to correspond with the different sizes of the tools.

"How can I cut the pieces apart?" asked John.

"You can do that very easily with a file," said Edward,—"a three-cornered file is the right kind. When you make your handle, shave down the small end till it is of just the size to be driven in about a quarter of an inch into the umbrella ferule. Then file a little notch in the ferule about where you think the end of the handle comes, and carry the notch all around by filing more and more. In this way the empty part of the ferule will be cut off, leaving a narrow portion on the handle.

"If you don't hit precisely at the point where the wood ends, it is of no consequence," said

Edward; "for if the wood projects beyond the brass, you can cut the part projecting off, and if it falls short you can drive the ferule on a little farther.

"In the same manner you can put what is left of the ferule on the next handle a size smaller, and so on until it is all used up."

The next day John began to work upon his handles, and he occupied all his working-hours for nearly a week in making different sizes of them, and in making and tempering brad-awls. At the end of the week he bought some files and also a number of large brad-awls, and fitted them into his handles, so that he had quite a number of very nice-looking tools, which he had procured too at very little outlay of money.

His plan, however, of oiling or varnishing his handles could not be carried into effect, for his mother was not willing that he should have oils and varnishes in the house.

"You must wait till the warm weather comes on," said she, "and then you can fit yourself some sort of shop out in one of the back-rooms, and there you can carry on the painting and varnishing business as much as you please."

John was satisfied that this was reasonable, and so he concluded to put off the work of giving the final finishing touch to his tools until the spring.

"You see, Benny," said he, "the handles will all get soiled and worn by that time, but I can sand-paper them all up again before I put the oil on, and then they will look as nice as if they were new."

CHAPTER V.

THE TOOL-CHEST.

During all the time that John had been engaged upon his handles and his brad-awls, his nail-box had remained unfinished, until in fact he had almost forgotten it, though there the parts lay—the bottom, the two sides, and the two ends—all ready to be nailed together. It is true there was a good reason for laying the nail-box aside for a time, inasmuch as John had no suitable boring instrument small enough to make holes for the brads with which it was to be nailed together. But when his uncle had made the first small brad-awl, he might have taken the work up again and finished it; but he had become so much interested then in making handles and needle brad-awls that he forgot about his nail-box.

At last Benny recalled it to his recollection.

"John," said he, "when are you going to finish your nail-box? You ought not to leave one thing unfinished and go off to work on other things in that way; ought he, mother?"

"Not unless there is some good reason for it," replied his mother.

"I will finish my nail-box the very next time I work," said John.

The finishing of the nail-box John found was very easily accomplished. He had only to bore three holes near the edge of one of the sides, taking great care to bore them carefully so as not split the wood, and also to bore them at such a distance from the edge that when the side was applied to the bottom, where it was to be nailed, the points of the nails should come as near as possible in the middle of the thickness of the bottom. After placing one of the sides, with the holes bored in it, in its place, he marked the places of the holes in the edge of the bottom-board, and then bored in a little way for each nail, taking care to bore in such a direction that the nails should enter straight into the substance of the board, and not run out on either side.

Then he nailed this side-piece on, driving the brads in very slowly and carefully, so as to be sure that all was going right. If he found that a brad was going in the least degree wrong, he stopped in season, drew it out carefully with the claw of his hammer, and then, putting in his brad-awl, he cut away the side of the hole a little on one side or the other, so as to alter the direction of it, and then put the brad in again.

When he had thus nailed on both the sides, he trimmed the ends of them off, to just the length of the bottom, and then nailed on the ends in the same way. The end-pieces, of course, extended beyond the breadth of the bottom, so as to cover the ends of the side-pieces. After the end-pieces were nailed on, John put one nail in at each of the corners, to hold the end-pieces and the side-pieces together, and the box was done.

I have been extremely particular in describing thus minutely all the steps of the process by which John made his first box, thinking it possible that many of the readers of this book may attempt to do the same thing, and they require very minute instructions in order to be able to succeed. Any boy of John's age, who will closely follow these instructions, proceeding slowly and carefully, and without any hurrying or eagerness to get his work done at any particular time, will find that he can make a very neat box, of this kind, that shall be quite strong and serviceable, and of any shape that he may desire; and that without any tools or materials excepting some thin wood to make his box of, a board to lay upon the table to protect it, a sharp-pointed knife, some sand-paper, brads, and a brad-awl made of a big darning-needle.

If you wish to make a cover to your box, you can do so. There are different modes of doing this which I shall presently explain. I must, however, first finish what I have to say about the nail-box, and also describe briefly a sliding-tray which John made for one of his drawers.

His mother helped him to contrive this tray. She was not much of a mechanic, it is true; but she took a great deal of interest in watching from time to time the progress of John's work, and she often assisted him by planning for him and making suggestions.

One day, when she saw him putting away his tools and materials in his drawer at the close of his work, she observed that it was very difficult for him to keep them well arranged and in good order; for the drawers being large, and having no divisions in them, there was no other way but to put the large and small tools and large and small blocks together in the bottom of them. And though John took great pains to arrange them nicely, still the opening and shutting of the drawers made them roll about, and soon mixed them all up together. He had particularly no good place to keep such little things as his spare ferules in.

"If I only had some boxes," said he, "to put some of my small things in, they would not get knocked about so much."

"That would do, said his mother; "but some sliding-trays, two for each drawer, will be much better, I think."

So his mother proceeded to describe to him her plan of sliding-trays, and John determined at once to go to work to make them. These trays, his mother said, were made to extend across the drawer, one at each end of it, and they were made to slide on thin strips of wood, which, she added, must be secured in some way to the sides of the drawer to serve as rails, as it were, for the trays to slide upon.

"I would rather not have them nailed to the sides of the drawer, if we can contrive any other way," said she; "for in case we nail them, then if we ever wish to take them away, the nail-holes will be left, which will deface the drawer."

"The brads that I should use," said John, "would make only very *little* holes."

"Very true," said his mother, "and I should not mind them much."

They, however, finally contrived a plan which avoided the necessity of nailing anything to the drawers. The plan was this. John cut out two long strips of thin wood, about two-thirds as wide as the drawer was deep, and set them up edgewise, one on each side of the drawer. Thus the lower edges of the strips rested upon the bottom of the drawer, and the upper edges formed the rails for the trays to slide upon. To prevent these two strips from falling over, or getting jostled out of place, John cut two narrow strips, like rulers, and made them exactly of such a length as, that, by a little crowding, they would fit in across the ends of the drawer between the two side-strips, and hold them securely in their places.

He then proceeded to make the trays, two for each drawer, one for each end. The trays were about eight or ten inches wide, and of such a length as exactly to extend across the drawer, along the ends, and rest on the two rails, and yet be loose enough to slide easily along them. He sand-papered the tops of these drawers and the lower edges of the trays, so as to make them very smooth, and then rubbed the surfaces with hard soap, as cabinetmakers do with the rubbing surfaces of bureau-drawers when they wish them to slide very smoothly and easily. John's trays fitted so well, and went so smoothly, that Benny found great pleasure in moving them to and fro.

Each tray was about three-fourths of an inch deep, and the rails were of such a height that the top of the tray should come about an inch below the top of the drawer. Thus the whole tray and the space above it only occupied about two inches of the drawer, which left plenty of room below in the bottom of the drawer for the things that were there, when the trays were moved to and fro. It was necessary to move them occasionally in order to gain access to the things in the bottom of the drawer that were under them.

John made the trays, of course, just as he had made the boxes, by first procuring a piece of wood of the right size for the bottom, and then fitting sides and end-pieces to them, and nailing them on.

He also made partitions in the bottom of the drawers, and likewise in some of the trays, by fitting in narrow strips of wood. Thus in a short time he had a great many separate partitions and compartments in his three drawers, so that he could assort and arrange his various tools, and his stock of materials, in a very convenient manner.

He assigned some of these compartments to Benny, and Benny took great interest in keeping his shops, as he called them, in nice order.

John was employed several weeks in making these trays, and in fitting them all into their places. During all this time his supply of tools had been gradually increasing, as he spent every week nearly all his salary in buying them. He had several files, but not so many as he would have liked, as he found that files were rather expensive. He had however a coarse flat file, for filing wood, and also a small three-cornered file, and a round or rat-tailed file, as it is called. To all these he fitted good handles, and he kept them nicely arranged in one of his trays.

He also had two marking-awls, as they are called; but these he made himself. They were for marking out work with, and consisted simply of pieces of wire inserted in a handle and ground to a sharp point at the end. One of the marking-awls which John made was large, for large work, and another was very small, for fine and delicate work. This small one was made of a darning-needle. It was very easy to make this one, as the point of the needle, in its natural state, was just what was required for the point of the awl. He had nothing to do but to make the handle nicely, and then crowd the eye of the needle well up into it.

One day, while John and Benny were at work in the back hall, they heard a sound as of a truck, or something of the kind, coming into the yard, and presently there followed a curious rumbling noise.

"What's that?" said John.

"I don't know," said Benny; "I mean to go to the window and see."

So Benny ran to the window and presently reported that it was Ebenezer who had come with a load of apples, which he was letting run down a slide through the cellar-window into a bin below.

"Good," said Benny. "Here is Ebenezer bringing us some more apples."

"I mean to ask him to come in and see my trays," said John.

So he went to the door and called to him.

"Ebenezer," said he, "I want you to come in, now you are here, and see my tools and trays."

"Not on *your* invitation," said Ebenezer.

"Not on my invitation," replied John. "Why not?"

"I never go into any lady's house," said Ebenezer, "without an invitation from the lady herself,—that is, unless I go on business," he added.

"Well, *this* is business," said John.

"It is not *my* business at any rate," said Ebenezer.

John paused a moment, as if at a loss what to say or do. He then disappeared from the door, but soon returned, saying,—

"Ebenezer, mother says that if you have time she would like very much to have you come in and see my drawers."

"Very well," said Ebenezer, "I'll come."

So when Ebenezer had finished putting down the apples he came in. He seemed quite surprised to find how neatly John had made his trays.

"You must have worked very patiently and carefully to do that," said Ebenezer.

"All the corners kept up very well," he added, after examining very particularly the corners of the pieces which formed the sides and ends of the trays.

"The corners?" repeated John.

"Yes," replied Ebenezer. "The chief difficulty with boys when they undertake to make a parallelopipedon is, they wear down and round off all the corners of their work. The great thing in shaping wood is to take care of the corners."

"I think they are good trays," said John.

"They are, indeed," replied Ebenezer.

'Mother likes them so much, that she says she wishes I would make a pair of trays for one of her drawers. She wants them to keep some of her little things in."

"You could make her some very neat trays," said Ebenezer; and if you could only *dowel* them on the sides."

"Dowel them on?" repeated John.

"Yes," said Ebenezer. "In dowelling them, there are no nail-heads to show on the outside of the box or tray, but the fastenings are all out of sight."

"How do you do it?" asked John.

"I can't stop to tell you now," said Ebenezer; "but the next time you come to my shop, while I am at work there, I'll tell you all about it. It's a pretty nice operation, but I should think that perhaps you might do it very well. Have you got a pair of cutting-pliers?"

"No," said John. "I don't even know what cutting-pliers are."

"A pair of cutting-pliers would be very handy," said Ebenezer, "but you can do very well with a file. But I advise you, the first time you get two shillings to spend, to buy a pair of cutting-pliers."

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CHAPTER VI.

A LEGAL DIFFICULTY—DOWELLING.

THE first time that Mrs Gay called upon the boys for a penalty incurred in breaking one of her rules, quite a serious law question—that is, a question about the interpretation of the law—arose. The case was this.

John was engaged that day in putting partitions into some of his trays. To do this, all that he required was his small brad-awl to bore holes for the brads, and a hammer to drive them in. He did this work at the table, making a bench for it for the occasion by means of his protecting board.

Such work as this of course makes no chips or borings, for the brad-awl, as has been already explained, brings out no wood from the hole which it makes, but only crowds the fibres aside as it goes in. Consequently John knew that his work that day was clean work.

While he was thus engaged, Benny was very busy upon the floor, splitting wood with what he called a beetle and wedges. He had a small mallet which John had made for him by first boring a hole in a round stick of wood by means of a small auger that he found in the shed, and then sawing off the wood about an inch and a half on each side of the hole, and finally fitting a handle into the hole. Then the mallet, or the beetle, as Benny called it, was complete.

John did this work very well, for although he had never attempted to make a mallet before, he had corrected his eye so much, and trained his hand so well by his careful work on his boxes and trays, that he could perform any mechanical operation much more exactly and more successfully than at first.

This is the reason why I have been so particular in describing all the minute steps of the process in making a simple box; for if a boy faithfully and carefully follows these directions, he will not only learn to make a box well, but will do everything that he undertakes better than he would have done without this training.

Such work as this, they say, "educates his ideas."

With this mallet and some wedges Benny was splitting wood. He had a piece of wood—one of the pieces which the boys had procured from under the bench in Ebenezer's shop—which he was splitting up. The piece of wood was about a foot long, and Benny was cutting it up into strips. He had a knife which Bridget had lent him. With this he made a little cleft in the end of the wood, to insert the edge of his wedge into, and then drove in the wedge with his mallet. In this way, as the wood was very straight-grained, he could split off a series of long and thin pieces; and as he made the pieces very thin, the wedge split them off quite easily.

"John," said he, "I am making some very nice strips of wood indeed."

"Let me see one of them," said John.

So Benny carried some of them to the table to show them to John. John said they were very nice indeed. He said, moreover, that perhaps that was the way that people made matches.

So he took one of John's strips, and laying it down upon his board, he found that with a ruler and a knife he could cut it very easily into long and slender bars, about as thin as matches, only they were a foot long.

"I verily believe these would make good lamplighters," said he, "instead of paper ones, which make so much black ashes to fly about the room. Go to the kitchen and ask Bridget to try one of them, and see if it will burn well, and ask her if she thinks it would make a good lamplighter."

Benny went, and pretty soon he returned, saying that Bridget said it would burn very well, and she thought that such strips would make excellent matches—much better than paper ones. They would last a great deal longer, and would not make such black flakes to fly about the room.

Benny then went and showed the new kind of lamplighter to his mother, and she seemed as much pleased with it as Bridget had been. So the boys determined to make up a quantity of them, and John told Benny that if he would split out the strips, he would afterward cut them up into lengths; and Benny went to work accordingly.

He seemed to be very much delighted to find that he could make something that promised to be of real use,—so that here at least was one exception to the general principle which Mrs Gay advanced, as related in the first chapter,—that it was sufficient that anything should seem to tend to some useful result, to spoil it as an amusement for children.

Now, it happened that when Benny went to the table where John was working, to show him his strips, he brought with him, upon his clothes and upon the pieces of wood that he had split out, a number of slender little splinters, some of which, while he was standing there talking, fell down upon the floor, where, as the floor was covered with a painted carpet of rather light colours, they did not show much, and neither of the boys observed them. Benny went back to his place and proceeded with his splitting, and the boys continued their work, each in his own place, until the time expired. Then, when they put their things away, they swept up very carefully, three times, all the chips and splinters about the place where Benny had been at work, but thought nothing of the place near the table, because John had not been doing any work there that could make any litter.

The next morning, just before breakfast, Mrs Gay asked the children to go out with her into the back entry, and pointing down to the floor near the table—

"There!" said she. "Look. Don't you think the cat could find out that some mice had been nibbling here? It seems to me there is a penalty to pay."

"It was John," said Benny, "that did that. That was where he worked."

"But I did not do any work that could have made any chips," said John. "I was only boring with a brad-awl and nailing. It *could not* have been me. It must have been Benny that brought them here some time when he came to see me work."

John had forgotten about Benny's coming to show him the matches, but thought it probable that he came, as he often did, to look over him at his work.

Thus there arose at once a very grave question. There was no doubt that a penalty had been incurred. The difficulty was to determine who was the culprit that had incurred it.

It is one of the most difficult things in the world to make a law that shall not be liable to some doubt or uncertainty when you come to the practical interpretation of it. Mrs Gay thought that the rules she established were very explicit and precise. If there was the least perceptible indication of the boys having been at work to be found upon the floor, the boy that was in fault was to pay a definite fine; but she had left unprovided for the contingency which had now occurred, namely, the not being able to determine which one was in fault!

"Very well," said she, "I give up the penalty this time. The rogue escapes, as rogues often do, through the imperfection of the law. But from and after this time I shall amend the law thus, that if it can be ascertained which of you was in fault, then only that one shall pay the penalty. But if we cannot ascertain, then both of you must pay, John two parts, and Benny one."

"Ah, mother!" said Benny, "that would not be fair."

"Yes," said his mother, "anything is fair that I offer as conditions on which I let you have my drawers, and that you accept. Besides, that is really the way that all laws work. If any wrong is done, and the guilty one can't be found out, the whole community suffer more or less for it."

So it was settled that the law should be amended as Mrs Gay had proposed.

It may be imagined by some of my readers that Mrs Gay was somewhat disappointed and chagrined to find that she failed to secure the penalty of the broken law in this case. But, far from that, she was much pleased. She was glad of any excuse for not taking away a part of the boys' salary, provided it did not tend to make them more careless in time to come; and she was quite sure that, releasing them in this case for the reason above given, would not have that tendency in any degree. It would rather have a contrary tendency, for the conversation to which the incident had given rise, and the ground on which the penalty failed of being enforced, would, she knew, make them doubly careful, at least, for some considerable time.

Mrs Gay was so much pleased with the matches which John and Benny made, that she said she would pay a penny a dozen for three dozen of them. They were not only neat and convenient for use, but they gave out an agreeable resinous odour, she said, in the burning. She called them the patent aromatic lamplighters; and when the three dozen were made and brought to her for delivery, tied up in three neat bundles of one dozen in each, she paid the threepence, which the boys divided equally between them.

The next time that John went to Ebenezer's shop, he had explained to him the process of dowelling. This is rather a nice process, but the effect is excellent, inasmuch as the nails by which the two pieces of wood are held together by it are perfectly concealed. It requires some patience and a good deal of careful attention to do it well; but yet the process is so simple, that any boy of ordinary ingenuity can do it. John taught Benny how to do it, and he succeeded in dowelling two blocks together quite well; and when he had done it, he carried the work to his mother, and asked her to see if she could find out how those blocks were fastened together, and she could not.

It was a stormy day when John went to Ebenezer's shop to learn about dowelling. He almost always chose stormy days for going there, for in pleasant weather Ebenezer was generally employed in out-door work. He found him engaged at work upon his lathe.

Ebenezer was trying to make himself a lathe, which is a small and very curious machine for making all sorts of round things, such as round boxes, rings, handles, spindles, bed-posts, table-legs, and the like. He had been at work upon this lathe for some months, doing a little at a time, as he had leisure; and on the day when John went to see him, he was making what is called the fly-wheel, which is a heavy wheel placed on the axle below, to give the lathe when it is going a sustained and steady motion. It is generally placed at one end of the axle, where it is out of the way.

"Now, Ebenezer," said John, "I have come for you to show me how to dowell."

"I can't stop to show you very well," said Ebenezer; "but I can tell you."

"I don't think I can understand correctly," said John, "unless you show me."

"Then you must show yourself," said Ebenezer, "and I'll tell you how."

"First look under the bench and find two small blocks. No matter what shape they are, only you must suppose that you are going to make a box, and you must take one of them for the bottom and the other for one of the sides. Take them out to the other end of the bench where there is room for you to work."

John did all this, and taking his place at the end of the bench, he put one of his blocks down flat upon it, and brought the other up to the edge of it in the position of a side.

"The side is too long," said John.

"That's no matter," replied Ebenezer. "You can learn how to fasten them together just as well for all that. Now go and get a couple of brads out of my small nail-box, and a brad-awl of the right size to bore for them. It must be a little smaller than the brads."

Ebenezer kept all his tools and materials in such excellent order, and John was so well acquainted with the arrangement of them, that he knew exactly where to go for them.

Ebenezer then took out from one of his drawers an instrument, which he said was a pair of cutting-pliers. These pliers were shaped like nippers, with a pair of flat jaws, and near the joint a small pair of cutting edges, made for cutting off small wires and nails, or any small bars of metal.

"I can trust you with these pliers," said Ebenezer, "but I could not trust every boy."

"Why not?" asked John.

"For fear that they should serve them as Bill Booby did his. You see Bill saw me using my pliers, and when he found that they really cut off a wire as easily as you can cut a thread with a pair of scissors, he was so much pleased that he went home and teased his mother to give him money to buy a pair.

"When he got home, he went all about the house with his pliers, showing them to everybody, and cutting off pins with them. This was all very well; for pins, being made of brass, are pretty soft, and can be cut very easily. But then he went to cutting bigger things. He got the biggest wire he could find, and tried to cut that off. Now the edges of the cutters in such pliers are tempered extremely hard, because they have to cut metal. This of course makes them brittle. To remedy this, the jaws are made very thick, and with proper usage they will never break. But when you attempt by main force to cut something that they were not intended for, of course the edge breaks down. Bill Booby tried to cut a darning-needle in two with his, but that being made of steel, and hardened, would not yield.

So he took both hands to his pliers, and pressed them with all his might, when—crack! he heard something give way,—and, looking, he found a notch in the edge of his cutters. The needle was whole as ever.

"Now that he had broken his cutters in one place, he did not care much what became of them, so he went cutting at everything that he could find until he had notched the edges all up. He even tried to cut a key in two with them."

"Ha!" said John, "what a fool!"

"Yes," said Ebenezer. "Booby he is by name and booby by nature. In the end the cutters were all notched and spoiled. But now for the dowelling," he continued. "Take up one of the brads and look at the head of it. You see it is formed by a little projection of the iron on one side."

"Yes," said John, "I see it."

"Now, cut off that projection with the pliers; then you will have what you may call a headless brad. It is pointed at both ends, or rather, it is not pointed exactly, for brads are always blunt; but you can drive it either way if you first make a little hole for it. Now cut off the head of another in the same way."

When John had prepared his two brads, he proceeded thus,—following step by step the directions Ebenezer gave him. First, he bored two holes very near the edge of his side-piece, and on the inside of it, that is on the side that was to come against the edge of the bottom-piece. He made these holes at some distance apart, and took care not to bore them entirely through the wood. Then he drove in the two brads, putting the heads, or rather the ends that the heads had been cut off from, into the holes, and driving gently on the points. The holes were deep enough to take in about half the length of the brads, and as they were somewhat smaller than the brads themselves were, the brads went in tight and were very firm.

Thus, on looking on one side of the side-board, you could see the points of the nails projecting, as if they had been driven through, but on turning the piece over and looking to the back side, there were no heads to be seen.

John then pressed the points of the nails against the edge of the bottom-board to mark the places where the holes were to be bored there, and then carefully bored the holes. Then he inserted the two points of the nails into the holes; and finally, turning the wood down in a proper position on the bench, and striking on the back of the side-board with the hammer, he drove them in. The side-board was thus nailed tight to the edge of the bottom-board, while the nails themselves that held the pieces together were entirely concealed from view.

"Only," said John, "I have bruised the wood of my side-piece a little by hammering it."

"Yes," replied Ebenezer. "But when you are dowelling in earnest, you don't strike directly upon your side-piece, but put a block of wood upon it and strike upon that."

John was much pleased to find that dowelling was so simple a process. He thought that he could fasten the parts of his mother's tray together in that way, if he only had a pair of cutting-pliers to cut off the heads of the brads with. Ebenezer told him that he might file them off.

"Drive the brad a little into the end of a stick," said he, "so as to have a handle to hold it by, and then you can rest the head of it on your bench and file off the projection. But the best way for you now will be to take a dozen or two of my brads, and cut the heads of them off here with my pliers, only you must pay me for them."

"How much must I pay?" asked John.

"You must pay me in work," said Ebenezer. "You must turn the grindstone for me, while I grind some of my tools that are getting dull."

So John turned the grindstone for nearly half an hour, while Ebenezer sharpened his tools, and then he went home carrying with him two dozen headless brads in his pocket for dowelling.

He succeeded very well in making the trays for his mother's drawers by this method; and Benny, too, dowelled two blocks together.

"Who showed you how to do it?" asked Benny.

"I showed myself," said John, "though Ebenezer told me how."

Before concluding this chapter I ought to say that such dowelling as I have described, with small brads, will not make very strong work, without glue; but if you glue the joint before closing the parts together, it will be very strong indeed—the brads holding the pieces in close contact until the glue is dry and hard. But without glue the joint is strong enough for trays to go into drawers, and for boxes not subject to rough usage.

To make boxes stronger, workmen use longer brads. Sometimes they use slender nails, or pieces of round wire cut to the right length. For dowelling the parts of furniture together, the workmen generally use round pegs of hard wood, which, being made larger, hold better. They have a particular borer to bore the holes for these pegs, which they call a dowel-bit.

CHAPTER VII.

PROGRESS—IN THE WOODS.

THE great thing in mechanical operations, as in everything else, is to begin well; and after John had proceeded as far as is described in the foregoing chapters, his progress was very rapid and very satisfactory. He accumulated quite a number of tools and implements, a great many of which were made by himself. He procured several sheets of sand-paper of different degrees of fineness, and glued them upon boards, by which means they were kept flat and distended, and he could rub down his wood upon them much more conveniently that when they were loose. Besides these he prepared several small blocks by covering one side and sometimes one edge of each with sand-paper, and these he used as rasps and files, finding them more convenient for some purposes than the large sheets.

He bought with the money which he obtained by his salary a broad chisel, a pair of cutting-pliers, an oil-stone to sharpen his tools upon, and a little oil-can. His mother was willing, she said, to waive her objection to his using oil about his work, so far as a little oil-can for his oil-stone was concerned.

John bought his oil-stone very cheap, for it was not set in a block of wood when he bought it, and was, moreover, not very large. He set it himself. The usual way of setting an oil-stone is to cut out a hole in a block of wood large enough to receive it, by means of a mallet and a chisel. But to do this well you require a vice to hold the block of wood firmly during the operation.

Now John had no vice, so he adopted the following plan to make the bed for his oil-stone to lie in. He selected a block of wood of the proper size, which he called his foundation block. He then took a thin piece of wood, one that was somewhat thinner than the stone itself, and cut it out almost exactly to the size of the foundation block, only a very little larger. He marked out the size of his oil-stone on this thin piece, as near the middle of it as he could, and then cut out the wood within the mark, so as to make a square hole. To do this he first bored a row of holes all around the boundaries of the hole, just inside of it, and then, after taking the *core*, as he called it, out, he trimmed and smoothed the edges with his chisel and his knife, until the stone would exactly fit into it.

Finally, John dowelled the thin piece which had the hole in it upon the face of his foundation block, and thus the bed for the stone to lie in was formed.

As soon as his oil-stone was done, John took a great deal of interest in sharpening all his cutting edges upon it,—his knife, his chisel, and even his brad-awls. Always when he had done sharpening his tools he wiped the oil-stone clean before he put it away. He had a large number of little square pieces of cotton rag, one of which he used for this purpose on every occasion of using the stone. He called these pieces his towels, and kept them in a pile in the corner of one of his trays.

This oil-stone was probably the most useful thing he had, and the work which he did upon it was of more value to him, in respect to his mechanical education, than any other work that he did. It gave him a clear idea of an edge, and of the proper mode of producing one, and of the differences in the angles of inclination which are formed by the sides of the blades of different tools, according to the nature of the several substances which they are intended to cut.

He became so much interested in edges by this work, that he examined those of the knives in the kitchen, and of the different pairs of scissors which he found in the house, and he obtained a great many new ideas on the subject, which proved afterward of great advantage when he came to have bench-tools.

For thus far, notwithstanding the number of tools which he and Benny had, and the many things they could do with them, he had no bench-tools at all.

The principal bench-tools are planes and saws of different kinds, a mallet, and a set of chisels. But none of these things can be used to advantage without a bench and a vice; and even if they could be, they are not at all the proper things for a boy to begin with in learning to work with tools.

John tried to make a cover to one of his boxes. This box was of a long and narrow form, and was intended to be put upon a desk to hold pens and pencils. John made it out of thin pieces of mahogany, which he obtained from a cigar-box that he contrived to get in the town.

The cover which John fitted to this box was made to shut down upon the top of it, without hinges. He made it by cutting out two pieces of wood, one a little larger than the top of the box, and the other just large enough to slip into it, and then dowelling the two together, the smaller piece on the under side of the larger one. Then he rounded over the edges of the larger and upper piece, so as to make it smooth and easy to take hold of, and the two together made a very pretty and convenient cover, inasmuch as the lower piece, being just large enough to enter into the box, served to close it tight and keep the whole cover in its place, while the upper prevented it from going down too far, and also served to take it off by.

This box was so neatly finished, and the wood, moreover, being of a species of mahogany, was so pretty when it was nicely smoothed with sandpaper, that Mrs Gay recommended to John to take it to the cabinetmaker's and have it varnished. This he did; and when the box was dry and he brought it home, it looked as nice as if it had been made at the cabinetmaker's, instead of having been merely varnished there.

John had already received his salary for two or three months, and had bought a great many tools, chiefly of such kinds as could be used without a bench. But the spring was coming on, and as the weather would be warm and pleasant enough to allow him to work in some of the out-buildings around his mother's house without a fire, he was determined to have a bench, and a set of bench-tools. For this purpose he wished to gain all the money that he could; and so for this reason, if for no other, he was desirous of being faithful in the performance of his duties, so as to continue to earn and receive his salary.

One day Benny and John, with their cousin Mary, went out to spend a few hours in the woods. While there the boys heard a sound as of a man driving oxen.

"Hark!" said John. "I wonder if that is not Ebenezer."

"Who is Ebenezer?" asked Mary.

"He is a farmer's boy that lives about here," said John.

"He is not a boy—he is a man," said Benny.

"Well, a man then," said John. "At any rate he is a pretty big boy. I really believe that he is going into the woods with his team. Let's go and see."

There was a clump of evergreens growing out from the snow in the direction of the voice, which concealed the person whose voice the children heard from view.

"Run on, Benny," said John, "and we will see who it is."

So Benny ran on, and John and Mary followed. They found that it was really Ebenezer. He was going slowly along the road with a waggon drawn by a team of oxen.

"Ebenezer," said John, "may we ride?"

"Yes," said Ebenezer, "if you will jump on behind and not before."

So the children stepped over the stone wall, or rather over that small portion of it which appeared above the snow, and ran on after the waggon. They soon all got on safely, and sat down upon the end of it to rest, their feet hanging down.

Presently Benny got up from his seat and walked along to the front of the waggon, steadying himself as he went by the stakes at the sides.

Ebenezer was near the front of the waggon, where he could see and guide his oxen. He was seated upon a chain which passed across it from side to side, between two of the stakes. The chain was double where it passed across, and

Ebenezer had separated the two parts a little, so as to widen his seat, but still it did not look very comfortable.

There was a heavy mallet and several iron wedges lying upon the floor of the waggon, and near them was a bundle of hay tied round with a withe. In the side, in a socket formed for the purpose in a piece of wood nailed upon the outside of one of the long bars which formed the frame, was an axe. On the other side of the sled was a shovel, secured in the same way.

"Ebenezer," said Benny, "where are you going?"

"Into the woods," said Ebenezer.

"What for?" asked Benny.

"To get a load of wood," said Ebenezer.

"Wood to burn?" asked Benny.

"Yes," said Ebenezer.

Ebenezer was very patient in answering the questions which children asked him, and one reason why it was easy for him to be so, was that he made very short work of it, never attempting to do anything more than to give a simple answer in respect to the one simple point to which the question referred, leaving the child, if he wished for further information, to ask for it by new questions. Many people make it unnecessarily fatiguing and troublesome to themselves to answer the questions which children ask them, on account of their attempting too much, and giving too long and laboured answers, which after all do not satisfy the children so well as such short and simple ones as Ebenezer gave. For they cannot well understand but one thing at a time, and when they have received information on one point, they generally make a short pause to give their minds an opportunity to receive fully the first idea before they are ready for a second. Their minds are in this respect like a very long telegraphic wire, which requires a sensible time for an electrical pulsation to pass through it. So that if the operator sends the pulsations on so rapidly, that one follows upon another before the first is well out of the way, he mixes them together in confusion, and spoils his whole message.

"Ebenezer," said Benny, "why did you not take your horses, instead of the oxen, to come into the woods?"

"Because oxen are steadier in the snow," said Ebenezer.

"But, Ebenezer," said Benny, after a moment's pause, "our horse goes along very steady on the snow."

"That is because there is a good road," said Ebenezer.

"But sometimes he goes steady when there is not a good road."

"That is because the loose snow is very thin and light," said Ebenezer.

"Oh!" said Benny, in a tone of satisfaction. "Is not the snow thin and light in the woods?"

"No," said Ebenezer; "it is very deep and heavy."

"But it is very *hard*," said Benny. "We have been walking on it and sliding on it all the morning."

"It will get soft by-and-by," said Ebenezer, "when the sun grows warm."

"Ebenezer," said Benny, beginning again after a pause, "what are you carrying this bundle of hay out into the woods for?"

"To give to my cattle," said Ebenezer.

"Are you going to stop and let them have time to eat it?" said Benny.

"They will have time to eat it while I am loading the waggon," said Ebenezer.

"Oh!" said Benny.

"Ebenezer," said Benny again, after another pause, "what do you have an axe for on your sled?"

"To cut wood with when I am in the woods," said Ebenezer.

"And what do you have the mallet and wedges for?"

"To split the big logs," said Ebenezer.

"Oh!" said Benny.

"I'll help you to split the logs," he added, after a moment's pause. "I can split with wedges."

"Can you?" rejoined Ebenezer.

"Yes," said Benny; "John showed me how. "Only," he added, looking at the ponderous wedges that lay upon the sled, "I don't think I could split very well with such a heavy mallet and wedges as that."

Benny was still for a few minutes after this, and seemed to be considering what he had heard; for all these things, though they will appear so simple and obvious to older children who may read this book, were more or less new to him, and it interested and pleased him very much to have Ebenezer explain everything to him so patiently. At length, in looking around the sled, his eye fell upon the shovel.

"Ebenezer," said he, "I don't see what you need a shovel for in the woods."

"To dig out my cattle with, if they get set," said Ebenezer.

"Set?" repeated Benny.

"Yes," replied Ebenezer; "that is, if they sink down into the snow and can't get out again, I shall have to shovel the snow away to make room for them."

"Oh!" said Benny.

While Benny and Ebenezer were talking together in this manner, John and Mary continued at the end of the waggon, riding along and talking with each other very happily, until at last Ebenezer turned off into a sort of by-road which led into the woods, and after proceeding in this direction for some time he came to a place where there were some large piles of wood rising up out of the snow, and a great many tops of trees and branches here and there, half buried.

Here Ebenezer stopped the waggon, after bringing it up near to one of the piles of wood, and then put down the bundle of hay before the oxen, to let them employ themselves in eating while he was making up his load.

While Ebenezer was at work upon his load, the children rambled about the place amusing themselves with running over the snow and examining a thousand curious things that they found.

"Ebenezer," said John, "if we only had some matches we might build a fire."

"I have got some matches," said Ebenezer.

"And will you let us build a fire?" asked John.

"Yes," replied Ebenezer, "if you'll only take care and build it well to leeward of me and my cattle."

By building it to the leeward he meant in the direction the wind was blowing, so that the smoke should be carried away from him and the oxen.

But there was so little wind that it was difficult to find out which way it did blow. But Ebenezer gave them some matches, and they made a small fire of dry sticks and leaves which they found on the side of a sloping sunny bank, where the ground was bare; and when the smoke from this fire began to ascend, they observed which way it inclined, as it floated off among the tops of the trees, and so found out which way the wind was, and which was the leeward direction.

The children then went to the leeward from where Ebenezer was working at his wood-pile and sled, and there found a large stump, much decayed, which came up out of the snow. There was a hollow in the top of this stump, and they determined to build their fire there. John helped them to set it going, and then he went back to see if he could not help Ebenezer at his work.

He found he could help him by piling the small wood upon the waggon while Ebenezer was splitting the big logs with his mallet and wedges. While thus employed, the conversation fell upon working with carpenter's tools. John had worked during the winter in making boxes and other similar things, by means of simple tools, such as could be used upon a table in the house, or on a board upon the floor; but now that the warm sunny days of spring were coming on he had an idea of making himself a bench at a place where there was a sunny window in a corner of one of the sheds.

"Do you think I could make a bench?" he asked.

"It is easier to make a bench than it is to do any good work upon it after it is made," said Ebenezer.

"Couldn't I learn by myself," asked John, "if I had the tools?"

"You might do it in time perhaps," said Ebenezer, "but learning yourself without instruction would be inventing the art of carpentry anew. You are a pretty smart boy, but that would be rather a serious undertaking even for you."

"Then I do not see what I can do," said John.

"You can do as other young carpenters do," said Ebenezer; "that is, bind yourself out as an apprentice to learn the trade."

"Well," said John, "if you would take me for your apprentice."

"I will," said Ebenezer, "if you only agree to the conditions."

"What are the conditions?" asked John.

"They are only the usual conditions that apprentices have to submit to," said Ebenezer. "Plenty of hard work, no fun, very little that's good to eat, and no pay."

John laughed.

"If you try it," said Ebenezer, "you'll find it no laughing matter."

"No, but tell me seriously, Ebenezer, what you mean," said John.

"Well," said Ebenezer, "I'll tell you seriously. If you intend to have a bench and tools just for play, and think because the tools look bright and curious you can make things with them at once, without learning, then it will turn out just as it always does with boys in such cases—just as it did in Bill Booby's case."

"How was it with him?" asked John.

"Why, he teased his mother to let him buy a chest of tools. When it came home he looked the tools all over, and was very much delighted; but on trying some of them, he found they would not cut, for being new they had not been ground and sharpened.

"So he had to send them all to a carpenter's to be put in order for work. Then he found he could not work without a bench; and so his mother got a man to come and make his bench.

"When at length he got his bench and everything ready, he determined, for the first thing, to make a pigeon-house to put up upon the top of a tall pole in the yard. He was going to have it the shape of a church, with a belfry and a spire on the top, and a portico before the door.

"So he got a board and tried to saw it off, of the right length; but he could not make the board hold still. So he said he must have a vice; and his mother gave him some money to buy one, and to pay a carpenter to come down and put it upon his bench.

"Then he tried to saw off his board, but his saw would not go straight; and so the ends of the pieces, when they were sawn, were all askew. When he tried to plane them, the plane would hitch and stick, because it was set too rank. So he knocked out the iron and set it again, and now it would not plane at all. Besides, he had left the boards that his house was to be made of out in the yard, where the children trampled upon them, and filled the wood with sand and grit, which soon took off all the edge from his planes. When he tried to nail his boards together, first he drove the nails without boring, and they split the wood. Then he tried to bore holes, but he could not bore straight, and the nails came out in the wrong places. Finally he got in a passion and knocked his wood all to pieces with the axe, and in doing so he made one of the boards fly and hit his leg, which hurt him very much, and made him more vexed and out of humour than ever. He slammed the tools all back into his chest, and went in and told his mother that the man that sold them the tools was a cheat, for the tools would not work at all. He could not do anything with them.

"He has had them out once or twice since, and managed in just about the same way, and now his tools are lying about the shed, all rusting and going to destruction."

"What a silly fellow!" said John.

"But where does Bill Booby live?" he asked, after a moment's pause.

"Live?" repeated Ebenezer. "I don't really like to tell you where he lives, for you might go and get acquainted with him, and so follow his bad example."

"I don't believe there is any such a boy," said John. "Is there really?"

"Yes," said Ebenezer, gravely, "there are a great many such boys."

"But tell me about my being your apprentice," said John.

"Well," said Ebenezer, "I'll tell you. The first thing to be done in learning to work at a carpenter's bench is to learn to saw and to plane. And the best way to do that is, not to begin at first with attempting to make anything, but only to saw for the sake of learning to saw, just as you write copies at school for the sake of learning. But there's no particular fun in that sort of work, I can tell you. It is hard work and dull work. Still, if you wish to *learn*, that's the way; and if you do, I'll take you for my apprentice and let you do some sawing and planing for me, to teach you. If you do that, you can then, if you choose, have a bench, and a saw and plane of your own, and there will be some sense in it."

"When must I come?" asked John.

"Whenever you like," said Ebenezer. "Only you can't work more than an hour at a time, for it will be steady sawing and planing, and you'll get tired in an hour."

"Well," said John, "I will tell my mother about it, and see what she will say."

"But remember," said Ebenezer, "that this is a plan for *my* benefit and not for yours. When a carpenter takes an apprentice it is for his own benefit, and not to do the apprentice a kindness. I have got considerable sawing and planing to do, for a certain job I have in hand, and I think it will be easier for me to get you to do it, notwithstanding the trouble I shall have in showing you how; and if you think that the advantage of learning will be enough to pay you for all the work you will have to do, without making anything for yourself, then it will be a good bargain for both of us."

By this time Ebenezer's load was ready, and the children's fire, too, was wellnigh burned out. So Ebenezer set out on his return. They went on very safely for a time, but at length their progress was suddenly arrested by what seemed at first to be quite a serious accident.

CHAPTER VIII.

A DIFFICULTY—THE YOUNG APPRENTICE.

The accident which occurred was the sinking of the oxen down into a deep drift, at a place where the snow had been warmed by the sun which shone in there upon it through an opening in the tops of the trees, at a turn in the road.

It happened, moreover, that the snow here was very deep; and being soft to the bottom, the oxen sank into it up to their shoulders.

When they first began to sink, Ebenezer tried to hurry them on so as to get over the bad place quick. The oxen had, however, sunk deep into the snow, but were standing very still and quiet there, chewing the hay that they seemed to have still in their mouths, and looking now and then up to Ebenezer with a perfectly calm and contented expression of countenance, as if they had full confidence in his being able to do what was required to get them out, and in the meantime felt entirely at their ease.

"Now, Ebenezer," said John, "it is a great pity that you did not bring your horses instead of the oxen; for they have got much longer legs, and so can wade through deeper snow."

"No," said Ebenezer. "You see, if I had my team of horses in such a fix as this, they would struggle and thrash about, and break everything to pieces. The oxen stop and stand quiet, waiting for me to come and tell them what to do."

"I don't see what you are going to do," said John.

"You don't see now," said Ebenezer, "but wait a little and you will see."

Ebenezer went to the side of the waggon and took the shovel, and then going out before the oxen, he began to dig the snow away. The oxen stood perfectly quiet and allowed him to work close to and all around them. Benny was very much astonished to see how little regard he seemed to pay to their heels and horns.

"Look out, Ebenezer," said he, "or they'll gore you."

"No," said Ebenezer, "they won't gore me. They don't wish to drive me away. They want me to stay here and dig them out."

The snow was very damp and heavy, and came out in large masses as Ebenezer shovelled. He did not, however, throw out a great deal of the snow, but seemed intent rather on breaking the continuity of it, and trampling it down, than taking it out.

"Ebenezer," said John, "you will have to shovel out more snow than that, or else the oxen will never be able to get out."

"I must not shovel out too much," said Ebenezer, "for if I do the waggon will sink down into the hole so deep that I can't get that out."

After working in the snow in this way for a few minutes, until it was pretty well broken up, Ebenezer came out upon the hard snow on the side, saying,—

"Now, Bossies, I think it will do for you to start up a little."

The oxen, or bossies, as Ebenezer called them, remained perfectly quiet, waiting for him to give them their orders. Ebenezer took up his goad-stick, and, standing on the hard snow at the side, gave the command to the oxen to move on a little, and as soon as they had taken two steps he stopped them again.

The oxen obeyed his orders implicitly, and with an air of perfect resignation and composure. They took the two steps very slowly and deliberately, and then stopped, chewing the hay in their mouths all the time, as if they felt perfectly satisfied that if they quietly obeyed their master's directions he would certainly get them out of their difficulty.

"Now, Ebenezer," said John, "if you don't look out you will get down into that great hole that you have dug, and then you can't get out again."

"That's just what I am going to try to prevent," replied Ebenezer.

So saying, Ebenezer began to take off some of the smaller pieces of wood which lay on the top of the load, and to thrust them through under the wheels of the waggon. The children saw at once that his object was to make the wheels run on to these pieces, and be prevented by them from sinking down into the loose snow so far as they otherwise would have done.

For by this arrangement the weight of the load, as the philosophers say in such a case, instead of pressing wholly upon the narrow portion of the snow which came under the edges of the runners, would by means of the sticks of wood be *distributed* over a wide surface, and so be better borne up.

Thus a piece of board laid down over thin ice will sometimes make it safe to walk over it, when without such a distributor of your weight it would be very dangerous. It is well to remember this, for when a boy breaks through the ice on any pond or river, and the ice around the hole is too thin for the other boys to go near enough to help him, the first thing is to run to the nearest fence and get some boards to put down, and this will make it comparatively safe.

Ebenezer could not cover the whole of the loose snow in the hole with sticks of wood on account of the oxen being in the way, but after putting in enough to cover the space between the heels of the oxen and the wheels, he started the oxen on again a few steps. The oxen were perfectly obedient and quiet, and took a few steps at a time, just as Ebenezer ordered them; and as fast as they advanced, Ebenezer put pieces of wood down to continue his bridge, so that the waggon could follow without sinking much. In this way he went on until the oxen climbed out upon the hard snow where the sun did not shine; and, the waggon following them, all the trouble was over.

"There, John," said Ebenezer, "that's the way I want *you* to act when you get into difficulty with your work, if you come to be my apprentice.

Take a pattern by my oxen. Don't go thrashing about and trying to get out of your trouble by violence, and break everything to pieces, as horses would have done in that hole, but stop at once, and wait till I come to help you out, and then do just as I say, step by step, quietly."

"Yes," said John, "I will."

"And now," said Ebenezer, "help me to load on this wood again."

So saying, Ebenezer began to take up the wood which had been laid down in the snow. John helped him. John chose for his part all the smaller pieces, and left the larger ones for Ebenezer.

"You are wiser than Bill Booby was," said Ebenezer.

"Why? what did he do?" asked John.

"When I asked him to help me once," said Ebenezer, "he would not take the small pieces which were suited to his strength, but chose one of the biggest ones to show what he could do. He got up one end of it, and then called out to me that it was so heavy that he could not lift it, and he wanted me to come and help him. Finally, as I did not come, and he found that he could not hold up the heavy log any longer, he had to let it drop, and it fell on his toes."

"Did he hurt himself much?" asked John.

"I don't know," replied Ebenezer. "I suppose he did by the noise he made. But you can't tell much by that, after all, in his case."

"Ebenezer," said John, after a short pause, "who *is* Bill Booby? I don't believe there is any such a boy."

"Oh, yes," replied Ebenezer; "there are a great many such boys."

When the sticks of wood were all put on, the children mounted behind, and Ebenezer drove on. In a short time they came out of the woods into the main road, where the track being well trodden and worn, there was no further danger of sinking in. They proceeded in this way until they reached the farm-house where Ebenezer lived, and from there the children went home by themselves, along by the side of the road, choosing the shadiest places that they could find under the trees and fences.

John told his mother what Ebenezer had been saying to him about becoming his apprentice, and she at once consented to allow him to do as had been arranged, for Mrs Gay had great confidence in Ebenezer, and thought very highly of him as an instructor for her boys.

So the first rainy day that came, John went to Ebenezer's to commence his apprenticeship. He had his choice of days, for it was a vacation at his school, so that, except one hour each day that he and Benny were required to spend at their studies, he had all his time at his own disposal. He very wisely determined to embrace the opportunity offered by this vacation to serve his apprenticeship at sawing and planing with Ebenezer.

John found Ebenezer, as he expected, at work in his shop. He was engaged in doing something about a lathe that he was making, and which he was intending to put up at a certain window near one corner of his shop.

"Ebenezer," said John, "I have come to begin my apprentice-work."

"Very good," said Ebenezer. "But did you ever hear of a run-away apprentice?"

"Yes," said John, "I have heard of such a thing."

"I'll tell you how it happens," said Ebenezer. "At the beginning the master-carpenter has more trouble in teaching the apprentice how to begin to use the tools—twice over—than all the good the apprentice does him. For a while he could do as much work himself in half the time that he spends teaching the boy, than the boy can do in all the time.

"So, you see, at the beginning the boy gets all the good, by being taught, and his master gets no good at all, or very little. But after a time, when the boy begins to understand it, then he can give his master some help, and so the master gets paid back for the time he lost at first.

"That is," continued Ebenezer, "if the boy is faithful and stays long enough. But sometimes, after he has learned to work tolerably well, instead of remaining to work for his master, as he agreed, he runs away and goes off to some other town, and there goes to work for some other carpenter, who will pay him. So he gets his instruction for nothing."

"That is very dishonourable, I think," said John.

"Yes," said Ebenezer; "but the apprentice always has some excuse for it. He says his master is cross to him, or makes him work too hard, or does not give him enough to eat; or he makes some other complaint of that kind."

"And what does his master do?" asked John. "Does he go after him and bring him back?"

"No," said Ebenezer. "Such a boy is not generally worth bringing back. But to prevent their apprentices from doing so," continued Ebenezer, "the masters generally bind them by an indenture to stay a certain time. An indenture is a contract in writing. The reason why it is called an indenture is, because it is, or at least it used to be, made in two parts, one for the master and one for the apprentice, and these two parts are written on the same sheet of paper, and then cut apart in a waving line, so that the edges of both papers are *indented* in exactly the same way, and thus they will fit each other precisely."

"What good did that do?" asked John.

"I don't know exactly," said Ebenezer. "They thought they could put them together again, and if the two parts fitted, that would show that it was all right. But now I am going to indenture you, or else I might expect that, after you have sawed here three or four times, and I had had all the trouble of teaching you how to do it, you 'll get tired and so not come any more. I 'm not willing to begin unless you agree to come seven days, and saw for me one hour each day."

"And how about planing?" asked John.

"That will be a separate apprenticeship," said Ebenezer.

"Well," said John, "I will agree to it."

"Then go and open that drawer," said Ebenezer, pointing to a drawer, "and take out a piece of paper and an inkstand and pen that you 'll find there, and come to the bench, and write what I shall tell you."

John did so, and when he was ready, Ebenezer directed him first to fold the sheet of paper in two, from one side to the other, so as to make the fold run down in the middle, from the top to the bottom. He was then to write what Ebenezer dictated first on the left-hand side of the line thus made.

Ebenezer dictated, and John wrote as follows :—

"This indenture witnesseth that John Gay binds himself to Ebenezer Greenwood as an apprentice for seven days, an hour each day, not less than three days each week, and that Ebenezer Greenwood promises to teach him the art and mystery of sawing."

Having written this, John, at Ebenezer's direction, made a second copy of it on the other half of the paper, and then both the parties signed both the documents. Ebenezer then, after laying the paper down upon the bench, cut the two documents apart with the point of his knife in a waving line, and gave one of them to John, and put the other in his pocket.

"There," said he, "now you are a regularly indentured apprentice; and if, after you once begin, you get tired of the agreement, and don't come and serve your time out, I shall have a right to consider you as a runaway apprentice, and to put an advertisement about you in the papers, and put a picture of you at the beginning of it, running off with your bundle on your back."

John laughed and said, "Very well; I'll give you leave."

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CHAPTER IX.

SAWING AND PLANING.

BEFORE John commenced his work, Ebenezer explained to him that the job of work which he had undertaken, and which required so much sawing, was this, namely, to complete the enclosure of a part of the yard between the barn and the shed, by making a high fence across the open part; and the work which John was to do was to saw out the palisades.

"They are to be three inches wide," said Ebenezer, "and to be set three inches apart. Thus it will take six inches in breadth of stuff, or two palings, for every foot of space. Now the distance is about sixteen feet, and that will require thirty-two palings, and I am in hopes to get them all sawed out in the course of your seven days' apprenticeship. By the time you have done that work, you'll begin to be a good sawyer."

So saying, Ebenezer went out and took down, from a loft overhead in the shed, a long board, and bringing it into the shop he laid it across two tressels which were there all ready for it.

"Now," said Ebenezer, "the first thing you have got to do is to determine which is your straight side."

"Both sides of the board are straight," said John.

"Then you must decide which you will take to square from," said Ebenezer. "The sides of a board, as it comes from the mill, are generally not parallel. The board *tapers*, as the stem of the tree did that it was sawed from. You must choose one side or the other for the one you will square by, in cutting it up into lengths, or else if you cut across in one place, squaring by one side of the board, and in another place by the other side, your cross-cuttings will not correspond."

So John chose one side of the board as the best to take, and Ebenezer told him he must remember which he had chosen, and do all his measuring and squaring from that.

"Now," said he, "lay down the square with the short arm across the board, as close to one end as it will do to go, and mark a cross-line."

To do this, Ebenezer gave John a large iron square, such as carpenters use in framing buildings. This is different from a joiner's square, which has one arm of wood that is made pretty thick, while the other one, which is of steel, is quite thin, so that the square will fit as it were upon the edge of the board that it is applied to. Both arms of the carpenter's square, on the other hand, are of thin iron or steel, and are precisely alike, except that one is usually two feet long and the other only one foot.

"Now," said Ebenezer, "measure from your cross-line along the board, four feet seven inches with the two-foot arm of your square. That's to be the height of my paling."

"You ought to say the two-*feet* arm of your square," said John. "Two *foot* is incorrect, because foot is singular."

"It is not so in the shops, at any rate," said Ebenezer. "It is exactly the contrary. It would be very singular to say two-feet rule among the carpenters, and to say two-foot rule would not be singular at all."

John was somewhat puzzled by this reasoning, and he was still more perplexed at Ebenezer's asking him,—

"And ought I to say, according to grammar, a ten-pence nail, instead of a ten-penny nail?"

Like most reasoners, who, when they have once enunciated a principle, think they must stand by it, wherever it carries them, John said, though rather faintly,—

"Why, yes, certainly. *Ten-penny* is not correct. Penny is singular."

"Oh, John," said Ebenezer, laughing aloud, "think of my going to the hardware store and asking for a pound of tenpence nails, and all to avoid being singular."

And Ebenezer laughed again, louder than ever, at the idea.

Then suddenly checking himself, on perceiving that John looked a little troubled, he said,—

"I 'm not laughing at you, John. I am laughing at the grammar. You are right about it, I don't doubt. That 's what the grammar says. But never mind that now. Measure off from your first cross-line four feet seven inches, to the place where you are to make the second one."

"What do you put the seven inches in for?" asked John. "Why don't you make it exactly four feet?"

"Because my boards are about fifteen feet long," said Ebenezer, "and I find I can get out three lengths of four feet and seven inches, and that is all I *can* get,—allowing for the waste at the ends."

In obedience to Ebenezer's directions, John applied the two-foot arm of the square to the board twice in succession, marking the place of the end precisely at each application with the marking-awl. At the third application he pressed the point of the awl into the board at the place where the mark for seven inches came.

"There," said Ebenezer, "that 's the end of your first length. Mark it with a V."

"With a V?" repeated John.

"Yes," said Ebenezer. "I 'll show you how."

So saying, Ebenezer took the marking-awl, and putting the point at the little hole which John had made to mark the seven inches, he made two scratches from the point, first in one direction, and then in another at a little distance from the first, thus making a rude resemblance to the letter V.

"There," said Ebenezer, "that's the way that carpenters mark the places where they are going to cut. The V helps them to see and find the place quicker, and distinguishes it from those where they only made a prick to mark the end of the square or rule in measuring. And when you come to plane your board, these scratches will all plane out."

"And now," continued Ebenezer, "mark the line to saw by, right across the board, exactly through the point of the V."

John was proceeding to do this, and had placed his square in what he thought was the right position, when Ebenezer interrupted him, saying,—

"Stop; that is not right. You are squaring by the wrong side of the board."

John at once perceived his mistake, and immediately changed the square so as to make the cross-line that he was about to draw square with the edge of the board which he had selected at the outset to be governed by.

"Always," said Ebenezer, "when you are going to saw off a board, lay down the square, and make a mark to saw by. Bill Booby's way is to saw first, and then put on the square to see if it is right afterward."

"What does he do so for?" asked John.

"Because it is easier to guess than to measure and mark," said Ebenezer. "But he guesses wrong, and so he has to saw again, and that makes his board too short."

"Hoh!" exclaimed John, in a tone of contempt, "he might have known that. And what does he do then?"

"He tries his board," replied Ebenezer, "and when he finds it is too short, and won't do, he throws it down upon the floor or ground in a pet, —saw and all—and goes off to play."

By this time John had measured off the three lengths upon the board, and had marked the cross-lines, taking care to square them all by the same side of the board. The last line came within a few inches of the end of the board—just near enough to clear the cracked and rough part of the end.

"And now," said John, "shall I get the saw and saw them off?"

"Not yet," replied Ebenezer. "You have got to make the other lines, lengthwise of the board, to divide into strips for the palings."

"You are first," said Ebenezer, "to measure off the width of the palings on the first cross-line that you made near the end of the board. The palings are to be three inches wide, but you must measure them off three inches and a quarter."

"What is the quarter for?" asked John.

"For waste," said Ebenezer. "You see, if you had a board exactly six inches wide, and were to saw it in two, lengthwise in the middle, the two parts would not be quite three inches wide each, for the saw would have taken out some of the wood. The two together would fall short of six inches, after they had been sawed apart, by the breadth of the cutting made by the saw."

"But that would be only a very little," said John.

"True," said Ebenezer, "it would be but little; but it would be something, and you must allow for it whatever it is, if you wish your work to be exact.

"Besides," continued Ebenezer, "it is not possible for any person to saw perfectly straight by hand. You can do it more nearly straight by machinery; but by hand the saw will deviate a little, and make a waving line. Then when you come to plane the edge, you have to plane all these wavings off, and that narrows your board still more. So the carpenters generally allow about a quarter of an inch for waste. But I think that, on the whole, *you* must allow more. You see, your first sawing will of course be pretty crooked, and the edges will have to be planed down more. You had better allow three-eighths."

"How much is three-eighths?" asked John.

"Why, two-eighths of an inch is a quarter," said Ebenezer, "and so three-eighths is a quarter and half a quarter more. We allow one-eighth for the extra crookedness of apprentice-work. That's a very small allowance. I am afraid you won't be able to saw with as little waste as that. But I don't like to allow any more, for fear that my boards should not be wide enough."

So John took off, with a pair of compasses which Ebenezer brought him, the distance of three inches and three-eighths from the long arm of the square, and laid that distance off as many times as it would go, on the first cross-line of the board, pricking deep holes at the points which he marked. While he was doing this, Ebenezer brought the chalk-line,—a long white cord, wound upon a spool. Ebenezer brought the spool in one hand, and a piece of chalk in the other.

"Now," said Ebenezer, "it takes two to use a chalk-line to good advantage if the board is long. I'll stay at this end with one end of the line, and you take the spool and unwind it as you go along to the other. Take this piece of chalk, too, and rub the chalk-line over it well as you go along."

Ebenezer passed one of the points of the compasses through the loop in the end of the chalk-line, and then pressed the point down into the wood at the mark which John had made at the first distance of three inches and three-eighths. As he did this he held the dividers in a slanting position, the top slanting off toward the end of the board. By this means, when John drew the line tight, the loop was drawn down close to the point of the dividers, and this made the line lie close along the surface of the board.

"Now, John," said Ebenezer, "lay down your square with the edge of the long arm exactly upon your last cross-line, and then pull the end of the chalk-line exactly across the mark for three inches and three-eighths on the edge of the square, and then snap the line."

John did so, and a long white line was made from end to end of the board, and just three inches and three-eighths from the edge which John had chosen as the one to measure from.

In the same manner the two boys chalked all the other lines of division running lengthwise of the board. The board was about a foot wide,—not quite a foot wide at one end, and a little more than a foot at the other. So that there was only breadth enough for three palings and a strip an inch or two wide at one end, and three or four in the other.

"There!" said Ebenezer, surveying the marks on the board with an air of satisfaction; "there's your work all laid out. Now for the sawing.

"There's a strip to come off on that side," he added, "and we'll take that off first, so as to save it of the whole length. We may want a long piece for something or other, and it is always best to take off *first* what is going to be left of your stuff, so as to save it whole—instead of cutting it up with the rest. So now go and get the saw."

There were several saws hanging up in a row near the end of Ebenezer's bench, two of which —the two largest—looked very much alike. John took one of them at random, and brought it to Ebenezer.

Ebenezer, after looking at the teeth of it, told John that he had brought the wrong saw. It was the other one, he said, that was for sawing lengthwise of the board. The one which John had brought was for sawing crosswise.

John said that both the saws looked exactly alike.

"The *teeth* are different," said Ebenezer.

Ebenezer then showed John the teeth of the two saws, and pointed out the difference between them.

There is something very curious about this, and something which it is a good thing for all boys to understand, although without actual saws to look at, it is somewhat difficult to understand. But I will try to explain it.

In a board, the fibres of the wood always run of course lengthwise, so that in sawing across the board the saw has to cut *across* the fibres, and to take out, as it were, a piece of each.

The teeth, therefore, in one for sawing across, are made to spread a little to each side—one tooth being bent over to one side, and the next to the other, and so alternately—and they are filed in such a manner as to present sharp edges running lengthwise of the saw. When such a saw is in use, to cut across a board, the outer points of the teeth cut the fibres across, one on one side of the cleft and the other on the other, and the middle portions push the pieces that are cut off out.

In sawing lengthwise of the board, the cutting edge of the teeth is *across* the saw, instead of being lengthwise of it, because the fibres of the wood now lie in a different direction. This gives the teeth of the two kinds of saw quite a different appearance, if you examine them minutely, although the general appearance of the saws themselves are much the same.

John having obtained the right saw, now laid his board down lengthwise upon the benches, which he had previously placed end to end, so as to lengthen the line of support. He placed the board in such a position, that the edge which he was going to saw off should project a little beyond the end of the benches.

"Now," said Ebenezer, "the thing to be done is to carry your saw *true*, without bending it from side to side, and keep exactly upon the line, and also bear on very gently."

So John began, and though he went very slowly at first, he went very correctly, and kept very close to the line. When he found that he was deviating a little, he contrived, by turning the saw a little one way or the other, to work back to it again.

After going on a little way in this manner, John had proceeded so far that the strip of wood which he was cutting off, becoming long, began to move about, up and down, and sometimes made the saw *bind*, or catch a little; and so Ebenezer directed him to get a small piece of wood for a wedge to put into the cleft, to keep the strip steady, and also to hold the cleft open a little, so that the saw would run more easily.

John looked under the bench and found a piece of wood which he thought would do for a wedge, only the end wanted sharpening.

"Shall I take your broad chisel and sharpen it?" said he.

"No," said Ebenezer. "I have not taught you to use the chisel yet, and it would not be safe."

"What would be the danger?" asked John,— "that I should cut my fingers?"

"No," replied Ebenezer. "I am not afraid of that. We don't usually give ourselves much concern about our apprentice's fingers. The damage that I fear is, that you might dull my chisel, and that would be of much more consequence. You see if you cut your fingers, they will get well of themselves, after a little time; but it would make me a great deal of trouble to sharpen up my chisel, if you were to get it dull."

Ebenezer finally told John that he could open the cleft wide enough to put in a narrow piece of wood without sharpening the end; and John did so, and then went on with his sawing.

After he had got to the end, Ebenezer came and took sight along the edge of the board where John had sawed, to see how straight it was. John stood by, looking on curiously, waiting the result of this inspection.

"Have I sawed it pretty straight?" he asked.

"We don't praise apprentices much," said Ebenezer, "especially when they are beginning, for fear it should make them conceited. People that know very little are always apt to be very vain of what little they do know."

John saw, however, plainly, by Ebenezer's looks, that he was well satisfied with what he had done.

"After you have sawed the boards across into short lengths," said Ebenezer, "you can see for yourself whether you have done it well or not, for I shall put them to a test."

"What test?" asked John.

"You'll see," said Ebenezer. "But now get the other saw, and saw across where you have marked."

"So John changed the saw for one intended to saw across the grain, and then began the second part of his work. He first cut off the end-piece, and then proceeded to the next cross-mark, and to the next, until he had cut out the three lengths into which the long board had been divided. While he was going on with this work, Ebenezer watched him from time to time, to see whether he was holding the saw straight and carrying it true, and also whether he was following the marks exactly.

At first John found the work very fatiguing, and he was obliged to stop quite frequently to rest; but as he went on he found that it became gradually easier. The saw seemed to work more freely in the cleft than it did when he first began.

At one time, when he was stopping to rest, he asked Ebenezer what the reason was that the saw went easier. Ebenezer told him it was because he carried it more true.

"You see," said he, "that, if when you are sawing you twist and wrench your saw from side to side, it will get pinched and bound in the cleft; or if it does not get actually bound, it will rub hard, sometimes on the one side and sometimes on the other. To saw easily, you must carry your saw very true, exactly up and down, in the centre of the cleft."

As soon as John had sawn off the board at all the crossings, Ebenezer told him to take the three lengths and set them up together, on end, upon the floor, and see whether they would stand exactly together.

When John had placed the boards in the position which Ebenezer had directed, Ebenezer said, "Now, if the bottom-ends are square, then the boards will all stand upright together, and the edges will come together all the way up. But if you slanted the lines different ways, either in the marking or in the sawing, then the edges will not come together at the top, but some will crowd out one way or the other."

"They don't come exactly together," said John.

"They are pretty near," said Ebenezer. "And now, if the boards were measured and sawed to exactly the same length, the tops will all come on a level."

"They don't come exactly upon a level," said John, "but pretty near."

"They are near enough," said Ebenezer.

"And now," said Ebenezer, "you have done enough for to-day. It does not do to work apprentices too hard when they first begin. Put the boards that you have sawed out together in a pile by themselves, carefully, so as not to rub out the chalk-marks, and clear away the rubbish. The next time you come you shall saw them up into strips. And now you can come, if you please, and see what I am doing about my lathe."

After this first lesson, John had afterward very little difficulty. The next time he came he sawed along the chalk-lines in each of the boards which he had cut out, so as to divide each board into three palings; and as there were three of the boards, it made nine palings in all which he obtained from the first long board.

The second long board John sawed entirely by himself, also the third and the fourth, which made thirty-six palings in all, which Ebenezer said was enough. By this time he had become quite an expert sawyer for common work.

"But don't get conceited," said Ebenezer, "and imagine that you understand all about sawing just because you have learned to do plain work like this. There are a great many other kinds of sawing, such as scroll sawing, and key-hole sawing, and fine sawing, and a great many others. And I advise you, if you have a bench and a saw, not to attempt to saw anything but good, fresh, new, and dry boards. If you attempt to saw wet, or old, or crooked-grained boards, you'll be sure to get into difficulty."

John finished the work of sawing out the palings before the end of the sixth day of his apprenticeship, and then Ebenezer said that he would give him the rest of his time.

"We sometimes do that," said he, "when an apprentice has been industrious and faithful. We give him some of the last of his time, so that he can work for himself and earn some money. So I'll give you your time for the seventh day; and if you are of a mind to come and saw out one more board into strips for a gate that I am going to make, I'll pay you by turning you something in my lathe when I get it done."

"Well," said John, "I will come. But what will you turn me?"

"I'll turn you some tool handles," said Ebenezer, "or a mallet. We can turn very pretty mallets in the lathe."

"Could you turn me a pair of handles for a jumping-rope?" asked John.

"Yes," said Ebenezer, "very easily."

"Then do that," said John. "I want a pair of handles for a jumping-rope for my cousin Mary."

John was so much encouraged by the success of his apprenticeship to the art and mystery of sawing, that he began to think more seriously than ever of his proposed bench, and he was quite desirous of finding some good place about the premises for setting one up.

He would have liked very much a small room for a shop, all to himself. But there was no such room that he supposed could conveniently be spared; so he gave up that plan, and concluded instead to find a window in some corner of the out-buildings where he could build his bench, and then, in order to keep his tools safe when he was not using them, to lock them up in a chest.

"Do you think I could learn to make a chest," said he one day to Ebenezer, "that would do to lock up my tools in?"

"Yes," said Ebenezer, "you could make some sort of rough box, but a chest or box would not be so good for you. Some kind of cupboard, with shelves, and a door to lock up, would be better. Then you could see all your tools better, and take out any one without disturbing the rest."

"But I thought that carpenters commonly kept tools in a chest," said John.

"Yes," replied Ebenezer, "they do. But that is because they wish to carry them about from place to place wherever they are at work upon different buildings. But when you wish to work in one place all the time, shelves are much better."

Ebenezer, moreover, told John of a certain corner in a back room at his mother's house, which he thought would be a nice place for him to put up his bench in. There was a window, opening toward the south, which would make it warm and pleasant for him to work there in many cold and blustering days in the spring, when it would not be pleasant out of doors.

This window was so near a corner that one end of the bench might be made to fit closely into the corner; and over that end of the bench, beyond the turn of the corner, would be a good place for the case of shelves.

"You can buy floor-boards at the wood-yard," said Ebenezer, "ready planed, and those will be good for the covering of your bench, and also for your case of shelves. That will save you the trouble of planing the sides of the boards, which is very hard work. You will only have the edges to plane, which is comparatively easy."

"Well," said John, "I will do that. But I don't know how many boards to buy. I wish you would calculate for me;—if I could only pay you in some way for the time it takes you."

"You might pay me by turning the grindstone," said Ebenezer, "only I have not got any grinding to do just now. But then I can trust you. You was such a faithful apprentice that you have got your credit up."

So Ebenezer took a small piece of chalk from a shelf above his bench, and a smooth piece of board from beneath it, and began to make his calculations.

"I can give you a pencil and a piece of paper," said John.

"No," replied Ebenezer; "carpenters usually do their figuring with a piece of chalk and a board."

"Let us see," said he. "How far do you suppose it is from the window to the corner where you are going to have your bench?"

"I don't know," said John. "About so far," reaching out his hands pretty far. "There are two barrels standing there."

"It must be about three feet," said Ebenezer, "and the window may be about three feet wide, and the bench ought to come about two feet beyond the window. We will say eight feet for the whole length,—and two feet six will be wide enough—say two feet ten; that, with allowance for waste, will take say twenty-four feet for the top."

So Ebenezer went on with his estimates, talking to himself and figuring. It is not necessary to follow him through all his calculations. It is sufficient to say that he estimated carefully the length and breadth of each part of the work which John was to do, and then multiplied them together to get the square feet of timber that each would require, making a liberal allowance for waste. After ascertaining the whole amount, he told John he would want about seventy-five feet of planed boards for his bench and his cupboard, and twelve feet scantling.

"The scantling is for the legs of the bench," said he.

"I am afraid I shall forget," said John.

"Then I'll give you a memorandum on a smaller board," said Ebenezer.

"But I am afraid the chalk will get rubbed out," said John.

"Then I'll write it with a pencil—a carpenter's pencil."

A carpenter's pencil being made for ruling—for sometimes carpenters use pencils instead of marking-awls, as, for example, when they wish to make plans or drawings of their work, or of parts of it, on a smooth board—is different in form from a drawing or writing pencil, being flat instead of round, and having a very strong thick lead, which will not easily break. Ebenezer, with his carpenter's pencil, made a memorandum upon a small smooth block, three or four inches long.

"There," said he, "that's the wood you'll want for your bench and cupboard. It will cost ten or twelve shillings. Your mother can do just as she pleases about giving you the money; but I can tell you one thing, and that is, that, unless you have more steadiness, patience, and perseverance than most boys have, it will be money thrown away."

"I mean to do the best I can," said John.

"I'll give you four rules," said Ebenezer, "and

I advise you to write them down handsomely on a piece of paper, and make an ornamental border around them, and put them up in your shop where they'll be always in sight."

"Well," said John, "give me the rules."

So Ebenezer gave the rules thus:—

"Never nail without boring.

"Never saw without marking.

"Never mark without measuring.

"And never attempt to do anything with an unsuitable tool, or with a dull one.

"When boys attempt carpentry work," continued Ebenezer, "they almost always break down in one of those four ways. They try to nail without boring, and split the wood. They saw without marking, and saw crooked, and so the piece does not fit. They mark without measuring, and mark wrong. And they try to work with a dull tool, or one not intended for that kind of work, and so either break the tool or spoil their job."

"But sometimes my tools will be dull, or I shall not have one of exactly the right kind," said John.

"Then leave your work and go and do some other kind of mischief, if you must do some mischief or other. Mischief with carpenters' tools is the very worst kind you can do."

John took his memorandum and went home, and reported to his mother the result of Ebenezer's calculations. He said that he had partly enough money to buy the wood already, and that he was going to save all he could, until the money was made up.

But his mother told him that she was willing herself to furnish funds for the bench and cupboard.

"Indeed," said she, "it seems to be right and proper that I should, as they will both be fixtures, and when you have done with them they will be left there, and will be very convenient for some of my household purposes,—that is, if you make them well."

"But, mother," said John, "I don't expect to be done with them at all. I expect to go on using them all the time."

"True," said his mother, "until you grow up or go away to school or to college. But this house will last probably a hundred years, and your bench and cupboard, if you make them well, may remain perhaps all that time, and whoever lives here then will have the benefit of them. Whenever the house is sold, your bench and cupboard will add to the value of it, and so, you see, it is right that the owner of the house should pay part of the expense.

"So we will divide the business in this way," continued Mrs Gay. "I will pay for the wood, and you shall do the work. Then the bench and the cupboard shall belong to you as long as you remain to occupy and use them; and then, when you have entirely done with them, they belong to the house."

John was well pleased with this arrangement, and he began to feel a new and stronger interest than ever in the work that he was about to undertake, from the fact that he was going to make something that might perhaps last a hundred years.

CHAPTER X.

THE CARPENTER'S BENCH.

JOHN, as we saw in the last chapter, obtained money from his mother to purchase wood to make the bench. He then went to Mr Gear, a respectable timber merchant, and, with the assistance of Ebenezer, made a selection of pieces suitable for the purpose.

Ebenezer gave John very particular directions how to proceed in making the bench. I shall not, however, attempt to repeat these directions in the words which Ebenezer used, but the reader will understand what these were, by seeing what John did in carrying them into effect.

The first thing to be provided was a small, low bench, to serve as a saw-horse to saw his boards upon. A boy cannot saw to advantage without having a low bench to saw upon. It must be flat upon the top, so that the board will lie steadily upon it; and if the board is very long, it is necessary to have two.

And yet these benches or saw-horses are quite difficult to make, on account of its being necessary to have the legs *spread* a little toward the floor, to prevent the bench from toppling over. Now, to make legs and set them so that they will spread in this way, requires a knowledge of angles of inclination, and a degree of art and experience in working at an angle, that few boys possess. So Ebenezer told John that he had better not attempt to make a sawing-bench, but to borrow Bridget's washing-bench, if she had one, and if she would lend it to him; for a washing-bench which is used to set tubs upon in washing was usually of just about the height, he said, that a boy would require for convenience in sawing.

A carpenter's bench bears some resemblance to a table, as it has four legs, and a plane surface above, supported by the legs at a height convenient for the purpose for which it is to be used. But it is curious to observe how things that are essentially alike come always to vary in certain details, according to the particular uses they are intended for. In a table, for example, the legs do not come quite even with the front of it, nor quite even with the ends. In other words, the upper surface projects on all sides, a little.

In a bench, on the other hand, the legs are always exactly even with the *front*, but they are a considerable distance from the *ends*.

It follows from this, that, in a carpenter's bench, the upper surface does not project at all in front, while it projects a great deal at the two ends.

There are good reasons for this, which arise from the peculiar uses that a bench is to be put to, so different in some respects from those of a table. In the first place the covering of the bench must not project in front on account of the solid work which has to be done, and the heavy blows which are to be struck, sometimes very close to the margin, so that the edge of the board forming the top would be very likely to split off if it were not well supported. And if it were not to split off, it would yield and spring more or less, under the blows of the hammer given to the work resting upon it; and the workman needs something very solid for his work to rest upon, when he is driving nails, or cutting with a chisel or mallet, or performing any other similar operations.

So important is this that cabinetmakers not only bring the front support of their bench close to the outer edge of it, but they make the top of very thick and heavy plank, and that of the hardest and most solid wood that they can procure.

But though the bench along the sides must not project at all over the legs, and over the side-board which is nailed to them, the *ends* project a great deal,—that is to say, the legs, though placed flush with the sides, are drawn in, a foot or more, from the ends. There is a good reason for this, too, and it happens that the reason is the same for this as for the other peculiarity, namely, to give the bench greater solidity at the part where the carpenter does his principal work. Although he is obliged to hammer close to the side of his bench, he has no occasion to do it very near the *end.* So he brings the left front leg away from the end, *in* a foot or more towards the place where he usually stands at his work. This brings the solid support of the leg close under his hammering, and this deadens the spring of the wood very much.

You can see, if you choose, how important it is to deaden this spring by taking two nails exactly alike, and trying to drive one into a board that lies upon a heavy flat stone, like a door-step, and the other into the same board—which ought to be a pretty long one—when the two ends rest upon two chairs, and it is entirely unsupported in the middle. The nail will enter very easily when the board is on the stone, while it will be very difficult to make it go in at all when the board is placed in such a manner that it *springs* under the blows.

A very little difference in the yielding of the support on which the board rests will make a great difference in the facility with which the nail may be driven in. If you put one board first on a table or on the ground, and then upon a thick plank, or upon a large flat stone, you will see at once that a nail can be driven into it much more easily in the latter case than in the other.

So, you see, it is very necessary that a bench upon which any heavy work is to be done, should be made as solid and substantial as possible; and if you have not a thick plank to put on at the top, you must at least bring the front legs close to the front side, and also away from the ends some distance, so that they may come more directly under the place where you are going to do your heavy work.

Ebenezer explained all this to John, and showed him how he must put his bench together in accordance with these principles.

"How long will it take me to get my bench finished?" asked John, when talking with Ebenezer on the subject.

"Ah," said Ebenezer, "there 's the trouble. Before a boy begins a job of work, his first question is, how soon shall I get it done; and he is so impatient to see it finished, that he hurries on and spoils it. I advise you not to think at all about getting it done, but only of the *doing* of it. Your first work is to saw out boards enough, eight feet long, to cover the top and to make two pieces to go along the sides,—one for the front and the other for the back.

"To choose boards for this, and measure out the lengths exactly, and mark the ends square, and saw them off straight and true, and then pile them up neatly by themselves in a pile, with the ends all exactly together, is enough for one day's work. Do that day's work by itself. Do it as well as you can, and think only of that. It won't be time for you to think anything about getting your bench *done*, for a week or fortnight yet."

In obedience to these directions John determined to saw off a number of boards eight feet long, for the top and sides of his bench, for his first day's work, and not to think of anything beyond that.

With the money that he had laid up from his salary he had bought one saw, of the kind for sawing crosswise. Ebenezer told him that he would have very little lengthwise sawing to do at first, and that little he could do very well, though not so fast, with the cross-cutting saw. So he had better buy only one at a time.

"But what shall I do for a square?" asked John.

"True," said Ebenezer, "you must have some sort of a square—I'll make you one."

So saying, Ebenezer pulled out from under his bench a piece of short wide board, and from this, after marking the corners carefully with his own square, he cut out a piece about a foot wide and fifteen inches long. He smoothed the edges all around with his smoothing-plane, and then examined the angles anew with his own square, so as to satisfy himself that they were perfectly true.

"There!" said he, "that will do for you till you get far enough along to have an iron square. It is not convenient to use, but that's no matter."

"But, Ebenezer," said John, "one of your rules was that I must not try to do anything without a suitable tool."

"This square is a *suitable* tool," said Ebenezer. "I only said it was not a *convenient* one. If you had a great deal of work to do, you would get along with a regular carpenter's square much faster; but with care, and taking a little more time, you can do the work just as well with this, and so it is perfectly suitable. An unsuitable tool is one that won't do the work well, or is likely to lead to some mischief,—as when you try to bore a hole with a penknife, and break your knife, or to drive a nail with a stone, and so bruise and spoil your work. Never attempt to work in that way,—unless, indeed, you are in an extreme case."

In accordance with these instructions John commenced upon his bench.

Benny, as John said, always turned his work into play, and at first John thought that he would rather have him out of the way while he was sawing out his boards. But reflecting that it was his duty to take care of him and help to amuse him, and knowing very well that Benny would be quite desirous of being with him to see what was going on, he concluded to let him come.

"And I will try to beat him on his own ground," said John to himself. "He will try to turn my work to his play, and I will see if I can't turn his play into my work."

So he called to Benny and said,—

"Benny, I am going to be a carpenter this afternoon. How would you like to be my apprentice?"

"I don't know," said Benny, looking somewhat uncertain.

"And your name shall be Jack."

"Well," said Benny,—his countenance brightening up at once at the idea of being named Jack.

"And shall you pay me?" asked Benny.

"No," said John. "They never pay apprentices, but only give them their breakfast, dinner, and supper every day, and teach them a little how to work."

"Well," said Benny, "give me my breakfast then before I begin."

"No," said John. "It is not quite breakfast-time yet, Jack. We have got to carry this bench out into the shop first. You take hold of one end, Jack, and I'll take hold of the other."

When they had taken the bench to the corner where John was going to have his shop, they put it down, and then John said,—

"Now, Jack, you are to stay here and take care of the shop while I go to market and get some provisions."

So John went into the house and asked his mother if she would give him a cake and a few lumps of sugar. He said they were for provisions for his apprentice Jack.

Mrs Gay understood this at once, and went into a closet and presently returned with a round flat cake and several small lumps of sugar, all upon a small plate. John took these provisions, and wrapped them up in a paper, having first broken off a small piece of the cake, and wrapped it up, together with a small lump of sugar, in a separate piece of paper.

Then he went back toward his shop-corner, as he called it. On his way he stopped at a door which opened out into the yard very near the place, and put the paper which contained the small piece of cake and the little lump of sugar down upon the step. Then he went on, and when he reached the place where Benny was sitting he said,—

"Now, Jack, you have been a very good boy to stay here and take care of my shop while I have been to market, instead of running off to play, as lazy and bad apprentices do. Now go out to the steps and get your breakfast. You will find it there wrapped up in a piece of paper. When you have eaten your breakfast, then come back and help me to overhaul this pile of boards."

Of course it did not take Benny long to eat his breakfast, but the pleasure which it seemed to give him appeared to bear no proportion to the quantity which he had to eat, for he came back capering about with delight.

"Now, Jack," said John, "look sharp, and help me to overhaul these boards."

So Benny, going to one end of the pile of boards, while John remained at the other, the two boys together lifted off one after another of them, to enable John to select and take out such as he thought best for his bench. He required two of about a foot wide each, for the front and back of the bench, and then enough of others to make a width of two feet ten or three feet, for the top. He laid aside three boards, nearly a foot wide each—the best and smoothest that he could find—for the top, and also a nice one for the front. For the backside board he set apart one which was not so nice, as that side, being intended to go back against the wall, would be always out of sight.

John then went to work to measure, mark, and saw his first board; and then when that was ready he used it for a measure to get the exact length of the rest. His apprentice helped him in moving the boards, by lifting them at one end while John lifted at the other. In the intervals Benny amused himself in building houses with the blocks and short pieces of board which John sawed off from the ends of the long ones. Now and then, too, John would slip away and put a small piece of cake and a little lump of sugar upon the steps, and then send his apprentice there for his dinner or his supper.

Thus John's work went on very prosperously, and yet Benny was amused and occupied all the time, and was ready to help John whenever his help was required,—and all through John's ingenuity in falling in a little with Benny's desire to turn work into play.

John succeeded in sawing out five boards that day, three for the top and one for each of the sides, and then, according to Ebenezer's advice, he determined to put his work away. So he piled up his five boards neatly, fitting the ends together exactly, so as to make it appear how precisely they were of the same length. He put the rest of the boards in another pile, with the scantling upon the top of them, and then carried his saw in and put it away.

The following day, when John went to his work, he told his apprentice that the next thing he had to do was to saw out the legs for his bench. These legs were to be made of the *scantling*, as the carpenters call it,—that is, pieces of joist of the right size to make stiff and solid legs. The legs of a table must be comparatively light and slender, for a table must be made so that it can be easily moved about, and there is, besides, no necessity for its being made very specially substantial and solid. It is different with a bench in both these respects. It is never intended to be moved from place to place, and it must be very firm and solid for the work that is to be done upon it; and so the legs are made of scantling or joists.

The size of the scantling which Ebenezer had marked in his memorandum for John's bench was three inches by four. John bought the pieces, too, already planed, so that he had nothing to do but to saw them to the proper length.

He first sawed off one end of one of the pieces of scantling exactly square, by marking it with his square on all the four sides, and then carefully following the lines in his sawing. Then he measured the proper length, which was three feet nine inches, and marked and sawed again.

Then, taking this leg as a measure, he marked off the other three legs, and after carefully squaring the lines upon these, where he was going to saw, he cut them off in the same way.

"Now, Jack," said John, "we must nail on the two side-boards to these legs, one side-board to each pair of legs."

So he proceeded to lay down two of the legs upon the floor, placing them exactly six feet apart, from outside to outside. For Ebenezer had told him that each leg must be *set in* about a foot from the end of the bench, and this, as the bench was to be eight feet long, would bring the legs six feet apart.

Then he laid one of the side-boards along from one of the legs to the other, placing the upper edge of it exactly even with the upper ends of the legs. When he had placed the board in this position, he began to bore a hole in each board, at the place where it rested upon the leg beneath it.

He was intending to bore three holes in each board—one at the upper edge, one at the lower, and one in the middle. He bored the middle hole first, and when he found that the point of the gimlet had gone nearly through the board, he stopped and measured again, to see if the legs were still six feet apart. When he had adjusted them exactly at the distance, he drove the nails home.

The object of boring in such a case as this is, not to prevent the nail from splitting the wood, for a nail in the middle of a wide board could not split it, but to assist in guiding the nails right, so that they may go in straight.

Now, Jack," said John, "I must set my board exactly square with the legs before I drive the other nails."

"But you have nailed it already," said Benny, "and you can't alter it now."

"I have only put in one nail yet," said John, "in each board, and so I can move the leg one way or another until I get it exactly square."

John adjusted the legs in this manner by means of his wooden square, and then put in the other four nails. In the same manner he made the other side of his bench, and when both were finished he leaned them up against the wall, where they would be safe and out of the way, and then, piling up the remainder of his boards in a neat pile, he left his work for that day, well satisfied with the progress that he had made.

The next thing to be done when he came to his work again, was to cut out the end-pieces to his bench; and in order to get the length of these end-pieces, he had to select the three boards which were to form the top of his bench, and lay them down upon the floor and measure the united breadth of them. Then he had to take two inches off from this breadth, for the thickness of the side-boards; for the side-boards projecting one foot each way beyond the legs, the end-boards must of course go inside of them. In other words, the top-boards must not only make width enough to cover the length of the end-boards, but also to cover the edges of the side-boards which came outside of them.

I do not know whether all the readers of this book will be able to understand this very well. They certainly will not unless they have followed closely the whole account that I have given of the manner in which John went to work to make his bench. Indeed, I need not have been so particular in giving all these details, were it not that many boys will perhaps wish to fit themselves up a shop in this way, and they will like to know exactly how to proceed, especially as will often be the case they may have no Ebenezer to go to for advice and information.

When John had sawed out his end-pieces, he nailed them on in their places, Benny holding up the side-pieces one after the other while he nailed. Then the frame of his bench was complete, and it would stand firm of itself on the floor; and he had been so particular in measuring and marking everything, that it looked perfectly square in every part, and not a single board had been split in driving the nails.

The next day that John came to his work, he put the covering-boards on, and then set the bench up in its place, and sent Benny in to ask his mother to come out to see it. She was very much pleased to see how successful John had been, not so much for the sake of the value of the bench, though it was really a very good one, she thought, but on account of the habits of patience, perseverance, and system, which the doing of such work by such a boy tends so strongly to cultivate and strengthen.

"I think you have made a very good bench indeed," said she. "I am very much pleased with it."

"*Benny* and I," said John. "Benny has been my apprentice, and he helped me a great deal. I don't know what I should have done, if I had not had such a good apprentice."

* * *

CHAPTER XI.

A PLEASANT SURPRISE.

It happened very fortunately for John that no *planing*, but only sawing and nailing, was required in making his bench, for at this time he had not learned to plane; but he intended to go and serve his apprenticeship to the trade, as he called it, before he began his cupboard or case of shelves, for in that work some planing he knew would be necessary.

He explained to his mother, when she came to see his bench, what his plan was about his case of shelves. He was going to have it in the corner, he said, opposite the end of his bench, and he explained to her how many shelves he was going to have, and what tools he was going to buy when he had accumulated enough money.

"Only," said he, "I don't know exactly what to call the place. It is not a cupboard, for that is to keep dishes in, and this is for tools."

"You might call it a tool-case, or closet," said his mother; "or, as you mean it only to put your tools in, for the purpose of locking them up when you go away, you might call it your lock-up."

"That's exactly the name," said John. "I will call it my lock-up."

"I am going to be Ebenezer's apprentice next week," he added, "to learn to plane, and then I am going to begin at once on my lock-up. I don't mean to buy many tools, until I have got my lock-up finished, and a good lock and key on it."

According to the plan which John thus announced to his mother, he went to work at Ebenezer's all the leisure time that he had that week, and learned to use a plane pretty well. Some account of the lessons which Ebenezer taught him in this art will be given in the next chapter. He finished his apprenticeship on Friday, and he was intending on Saturday to begin upon his lock-up, but his mother told him that she had a plan for him and Benny to go away with her that day on a long excursion.

John felt at first somewhat disappointed at hearing of this plan, as he was quite eager now to finish his shop; but he knew that it would not be right for him to make any objection to his mother's wish, and, besides, he liked long excursions—no matter in what direction, or with what object they were taken.

John inquired of his mother, however, that evening at supper, what the excursion was to be the next day, and she told him that she was going to a town about ten miles off, where there was a nursery of trees and shrubbery, in order to purchase some plants for her borders and grounds.

"Is Wilmot going with us," asked John, "to bring the plants home?"

Wilmot was a man who worked at Mrs Gay's, and whose chief employment was to take care of the horses and cow, and also of the gardens and grounds. He was quite an elderly man, and very quiet in his habits, attending steadily to his work, obeying Mrs Gay's instructions most implicitly in all things, and scarcely ever speaking except to answer questions. He had been in Mrs Gay's service many years, though he lived all the time in a small house of his own with his wife, at a short distance from Mrs Gay's. If he had any children, they had grown up and gone away.

That evening, just as the family were sitting down to supper, Mrs Gay asked John to go out into the garden and tell Wilmot that she wished to see him before he went home. John went out, but soon came in again, and reported to his mother that he had delivered the message.

"But, mother," said he, "I saw Alonzo out in the yard. Did you send for him to do any work?"

Alonzo was a young man who worked at the oiner's trade, and who often came to Mrs Gay's to do some jobs.

"Yes," said Mrs Gay; "I wanted to see him about altering a shelf in my china-closet, and about some other things; but I thought he had gone home."

"I think *I* can do such things for you, by-and-by," said John, "when I get my shop done, and my tools all bought."

"Yes," said his mother; "I am depending upon that."

Just as the family were rising from the table after supper, Wilmot came in.

"Ah, Wilmot," said Mrs Gay, "I wanted to see you a moment before you went home. Take a seat."

Wilmot sat down in a chair near the door.

"I am going away to-morrow, and I wish you to go with me in the waggon. Can you leave your work to-morrow?"

"Yes, ma'am," said Wilmot.

"I shall be gone nearly all day, so you can tell your wife that you will not be at home as usual for dinner."

"Yes, ma'am, I will," said Wilmot.

"You may come to the door to-morrow morning with the waggon at nine o'clock."

"Yes, ma'am." Then observing that Mrs Gay said no more, he rose, bowed, and went away, and the next morning he came at the appointed hour.

After they were all comfortably seated in the waggon, Mrs Gay said, "Drive first to your cousin Mary's house, for she is going too."

Wilmot turned the horses' heads to go to his cousin Mary's, which was in the direction toward the town. After going on a little way, John saw some one coming toward them, wheeling a barrow with the ends of boards projecting from the side of it. Presently he perceived that it was Alonzo.

"Ah, mother," said John, "here is Alonzo coming to make your shelf."

As Alonzo passed, John perceived that he had a number of pieces of board upon his wheelbarrow, all looking new and freshly planed, and of different sizes, as if intended for some complicated work. There was a large box, with many tools in it, on the top.

"No," said John, "it must be for some other job. I only wish, Benny, that you and I had all the tools he has got in that box—and knew how to use them all."

The waggon drove on, and the children had a charming ride. It was now the end of April, and the roads in most places had become dry and settled. The grass, too, was beginning to look green, and the trees appeared as if the buds were swelling. Notwithstanding these signs of spring, however, there were still large patches of snow to be seen here and there,—the remains of the deep drifts which the wind had heaped up during the great storms of the winter, while John and Benny had been at work in the back-hall.

At length they arrived at the town where the nursery was. Wilmot drove, by Mrs Gay's directions, directly to the tavern. It was a small tavern, but a very neat and pretty one, with gardens and sunny yards around it. There was a side-door which opened into a large but neat and pretty yard, with a stable in the rear of it, and sheds and out-buildings going from the house to the barn, and a garden on the opposite side.

Under the window, near the door where the waggon stopped, was a flower-border, and at the time that Mrs Gay's party arrived, a nice and happy-looking girl was at work with a garden-trowel, digging around the roots of her plants, which were just beginning to appear above the ground.

She left her work and came to the waggon and assisted Mrs Gay to alight. Wilmot came too; and Mrs Gay and the children were soon conducted into the house and ushered into a pretty little back-room, where there were the remains of a fire, and a wood-box near, covered with paper like that of the room, and filled with carpenter's chips and small pieces of board and sticks of wood for making a quick fire.

"Ah!" said Benny, "here is some kindling-wood for us; let us make a fire."

So the children put on some shavings and sticks, and soon made a bright blaze, which it was very agreeable both to see and to feel; for out of the sun the air was still a little cool. Mrs Gay ordered dinner, and Olinda—for that they found was the name of the girl that they had seen at the door—began to set the table.

While she was doing this, the children, having made themselves thoroughly warm, went out to ramble about the yards and sheds, to see the poultry, and the animals in the barn. At length the bell rang, and they all came in to dinner.

After dinner the whole party went to the nursery, where Mrs Gay spent an hour in choosing and purchasing plants and shrubbery. The children spent most of the time in running about the broad walks and observing the operations of the various gardeners. Mrs Gay allowed the children, however, to choose four flower-roots or shrubs apiece, for themselves.

After selecting and paying for the plants and flowers, the party all returned to the tavern. When they arrived there, Mrs Gay gave Wilmot directions to bring out the horses.

"We will set out on our return, and walk on slowly," said she; "and you may take the waggon and go to the nursery and get the plants and flowers. They will be all packed and ready, I suppose, by the time you arrive there. If not, you can wait for them, and then when you have got your load you can come on after us."

Wilmot simply said, "Very well, ma'am;" and in a short time afterwards the party soon set out on their return home. They arrived about five o'clock. John and Benny went first to the barn to see the horses unharnessed and put into their stalls, and then helped Wilmot to draw the waggon, with all the plants and shrubs still in it, under an open shed, where the roots were all to remain undisturbed until the following day.

"And now," said John to Benny, "let us go and see how our bench looks."

So they ran into one of the back-doors that opened near the carriage-house, and after traversing one or two open rooms and passage-ways they came to the shop-corner, and were both at once overwhelmed with astonishment to perceive that a sudden and most extensive transformation had taken place there, as if by magic. Instead of the simple bench, bare and naked, which they had left there in the morning, they now found what appeared to be a full and well-furnished shop, with all the tools and appliances complete. There was a vice attached to the front of the bench, and a block fitted in the proper place to plane against. There was a row of tools in a rack across the window, and others hanging on the wall. The lock-up, too, had been made, and there were a number of tools on the shelves of it.

John and Benny were both so utterly astonished at this spectacle that they stood for a moment as it were transfixed, and seemed not to know what to say or do. At length John began to look at the tools, one after another, but he did not touch any of them. There were three saws hanging up over the bench, and two squares of different sizes, and three planes upon the bench in front of the window, and a gauge and a hammer. At the farther end of the bench, too, near the lock-up, was a small grindstone, while at the nearest end, in a sort of recess underneath, where the side-boards and top projected beyond the legs, was an oil-stone and a small tin can for containing the oil. Besides these, there were various other things which cannot be here particularly described.

As soon as John and Benny had in some degree gratified their curiosity, John said—

"I know, Benny, it is all mother's doings. It can't be anybody else. Let us go in and tell her about it."

So the boys both ran in to find their mother.

"Mother," said John, "how *did* my shop all get made so soon. But is it my shop, at any rate?"

"Yes," said his mother, "it is your shop. I was rather backward about spending money to buy you a chest of tools before you knew anything about using them, and even before I knew whether you would have patience, perseverance, and manliness enough to learn. But your making the bench as you did, so slowly and carefully, settled both these points. All those tools are yours. I am sure you will not abuse them. They are not all that you will want, but they will do for you to begin with, and you will gain money enough by your salary, if you continue to take as good care of Benny as you have done, to buy more, from time to time, as you find you want more."

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CHAPTER XII.

PLANES AND PLANING—THE GARDEN-SEAT.

If any boy who reads this book has a plane, or if he has access to one that he can have the opportunity to examine, he will find that it is a very curious instrument.

It consists of a pretty solid and substantial block of wood, with an opening cut through the middle of it for the blade which is to do the cutting to pass through. This blade is called the plane-iron. It is in fact made chiefly of iron, though a portion of it at the edge, enough to form the cutting part, is of steel.

The lower edge of the plane-iron is set so as to project a little way below the bottom of the plane, and it is kept firmly in its place by a peculiar shaped wedge, which is to be driven in tight after the iron is properly placed, when the plane is to be used.

The opening through which the plane-iron passes down through the plane is very narrow at the under side, being only made wide enough for the shaving that is cut to come in. It widens afterward toward the top, in order that all the shavings that do come in from below may come up without any difficulty, and be thrown out at the top.

In order that the wedge may not be in the way, and prevent the shavings from coming up freely, the middle of it is cut out, leaving only the two sides—which form a kind of fork—to run down and bind the iron in its place. If you take out one of these wedges and examine it, you will find it to be shaped in a very curious manner, and by putting it carefully back in its place, you will see the reason for all the peculiarities of the form of it, which is to make it hold the plane-iron tight by the two sides, while yet it allows the shavings to come up freely by it in the middle.

He must have been a very ingenious man who contrived it,—and yet, notwithstanding the ingenuity of the arrangements, they do not always perfectly succeed; for when the wood is wet, or partly decayed, or the tool is dull, or the workman unskilful, the shavings often do not run clear, but clog up the passage and stop the work entirely, so as to compel the workman, before he can go on, to knock the iron out, clear the jam of shavings away, and then put the iron in again.

The sharp edge of the plane-iron protrudes a little way from the lower side of the wooden stock in which it is set, the protrusion being just equal to the thickness of the shaving which it is intended to cut. The first thing that you have to learn, therefore, in managing a plane, is how to "set it," that is, how far to make the edge protrude. This will vary a great deal according to the work that is to be done.

If the wood is soft, and the piece is narrow, you can take off quite a thick shaving at every stroke; and in this case the iron may be set so as to protrude a good deal. On the other hand, if the wood is hard, or if the surface which you are planing is broad, so that at every stroke you cut a shaving of the whole breadth of the edge, then you can only take off a thin shaving at every stroke, and so the edge must be made to protrude but very little,—so little, that, when you take sight along the under surface of the plane, you see only a very slender dark line, fine almost as a hair, where the edge comes through.

It requires a correct eye and a nice habit of observation to perceive the slight differences in the setting of the plane-iron required for the different kinds of work; but until a boy has acquired this skill, he cannot do anything with a plane unless he has somebody at hand to adjust it for him properly.

Accordingly, the first thing that Ebenezer did when John came to serve his apprenticeship in planing, was to teach him how to set the plane. He gave him some palings to plane, both at the sides and on the edges, and he required him to do the sides and edges alternately, and to alter the setting of the iron every time he changed from a side to an edge.

A plane, too, he told him, must be set much lighter—that is, the edge must protrude less—when it is to be used by a boy than by a man, inasmuch as a boy has not strength enough to cut so thick a shaving.

Ebenezer taught John to hold his plane perfectly even and true, without canting it to one side or the other, and also to keep it perfectly level, both when it comes upon the board at the beginning of the stroke, and also when it leaves the board at the end of it, so as not to cut down any more at the ends than he did in the middle, as boys are very apt to do when they begin.

"How many kinds of planes are there, Ebenezer?" asked John.

"Oh, there is no limit to the number," replied Ebenezer. "There is an endless variety of them made for mouldings and groovings and all such things, but for common work *three* make a set."

"I don't see why you need three," said John.

"One for cutting down fast," said Ebenezer, "and one for straightening, and one for smoothing.

"The one for cutting down fast," continued Ebenezer, "as where you want to cut away the roughness of the sawed board, or a jagged edge, is called a *fore*-plane, or a *jack*-plane. It is comparatively small and easily handled, and the edge of the blade is not straight but curved, so that it protrudes most in the middle, and thus it cuts out a shaving that is thick in the middle and thin at the two ends. Of course it leaves hollows, though very broad and shallow ones, in the wood that you plane.

"The next is a very long and heavy plane, and has a straight edge to the blade. This is to make the work level and straight from end to end. To do this it is made long, so that the ends, stretching far forward and back, keep the plane level and prevent its following any waving in the wood. It is much heavier to handle and less easy to use, but it takes off only a very thin shaving, and in the end makes the board perfectly straight and flat."

"And what is that smallest plane of all?" asked John.

"That is the smoothing-plane," said Ebenezer. "It takes off a very thin shaving indeed, so as to smooth the wood all over perfectly after the other planes have been used upon it. Then, if you wish to make your work very nice indeed, you finish it at last by rubbing it with fine sand-paper wrapped over a block of wood.

"But of all these planes," added Ebenezer, "the only one that *you* will have occasion to use for a long time will be the fore-plane."

By the time that John had planed out the pieces for Ebenezer's gate he had learned to set and to use the fore-plane very well.

Ebenezer also taught him how to sharpen

his plane on the oil-stone, when it was a little dull.

"As for grinding it, when it gets very dull, that you can't learn at present," said Ebenezer. "It takes a man to grind a plane."

All these things about planes and planing Ebenezer taught John during his apprenticeship at the planing trade; so that when he saw the three planes which his mother had bought him, together with the other tools, upon his new bench, he felt in some measure prepared to use them. He held them up one after the other, and looked along the bottom-surface of them, to see if they were set right.

"What are you looking at?" asked Benny.

"I am looking," replied John, "to see if my planes are all set right — ready to be used."

"And are they set right?" asked Benny.

"Yes," said John. "And now the first thing I mean to make is a platform for me to stand upon at my work,—though I could work at this bench," he added, "as it is."

As he said this, John stood by the side of his bench and made motions with his smoothing-plane, as if he was planing with it.

"I could plane with it as it is, though it is rather too high."

For you must understand that John, according to Ebenezer's advice, had made his bench of the ordinary height as used by men.

"For if you do so," said Ebenezer, "then as you grow older and taller the bench will be right for you, and it will be right too for other workmen whom you may have sometimes doing work there. Then for yourself, while you are small, you can have a platform to stand upon, that will raise you to the right height."

"So the first thing that I shall do," continued John, as he put the plane back in its place, "is to make a platform to stand upon while I am at work."

"How are you going to make your platform?" asked Benny.

"You will see," said John.

John went to work the next day to make his platform. It was very soon done, as it consisted only of a board about four feet long, with three supports nailed to the under side of it, which supports consisted of three narrow strips of wood set up edgewise. These strips were wide enough to raise John, when standing upon the platform, about six inches from the floor; and this he found brought him to just about the right height to work conveniently at the bench.

When Benny saw how the platform was going to work, he said that he wanted one too.

"Very well," said John, "I will make you one too."

So he made a second platform of the same height with the first, and about four feet long. It was very considerate in him to make both the platforms of the same height, for by that means, when occasion required, he could place them together, end to end, and so extend the range of his walk almost the whole length of the bench.

This he found very convenient sometimes, when he had any long work to do—as, for example, when he had long boards to plane. At all other times Benny could have his platform, and be at work at the farther end of the bench, while John was employed at his end.

While the boys were employed upon the work of making the platforms, Mary came out to see the new shop. She was extremely pleased with it.

"How many tools you have got!" said she. "Why, I should think you could make anything in the world with so many tools."

Mary made the same mistake that other children so often fall into in not being aware how much more requisite skill was than tools, in order to "make things."

"Could not you make me a rocking-horse?" she asked.

"Ah! no," said John, shaking his head somewhat sadly. "I might perhaps make the rockers, but I never could make the horse."

"If it was only something that would rock," said Mary, "I should not care so much about its being a very nice horse. Could you make me a seat for my garden?"

"Yes," said John, "I think I could do that."

"Well, I want a seat very much," said Mary. "When I get tired of working, I want to sit down and rest, and I have no place to sit. Yesterday I tried to sit on my basket, but it bent down so much I was afraid it would break. Then I brought out a chair, but the legs sank down into the ground, and it almost tipped me over. Besides, I want something to put my papers of flower-seeds upon. I don't like to put them on the ground. Luly treads on them. She don't mind a bit where she treads."

John went to work at once, as soon as the platforms were done, to make the seat. He first made a plan of it on a smooth board, with a pencil, as he had seen Ebenezer do in similar cases. Benny stood by, looking on while he drew his plan.

He had three things to consider,—the length and the breadth of the seat, and also its height from the ground.

As to the length, he thought it would be convenient to have room upon it for two persons to sit,—one at each end,—and have space in the middle for the papers of flower-seeds. This he calculated would require about four feet.

So he drew a line upon his smooth board to represent four feet in length. He allowed one inch to a foot, so that his line was exactly four inches long. He obtained this length by placing his iron square down flat upon the board, and marking the four inches from the long arm of it, and then drawing the line, using the edge of the square for a ruler. Then he marked off one inch on the short arm of the square, and drew the line there too, making a square corner. Then he shifted the square so as to bring the corner at the other end of the long line, and drew another line there for the other end of the board; and finally drew another long line to connect the two ends of the short lines for the other side, and his drawing of the top of his seat was complete.

To determine the height, he made Mary sit down in several different places, until he found what was the most convenient height for her, and then adding two or three inches to that,—for he hoped that his seat would last a number of years, and Mary was all the time growing,—he fixed upon the height which he thought would be best for his seat, which he found, on measuring it with his scale, was about one foot.

He intended to make his end-pieces out of boards, with the lower corners cut off of each, in a sloping direction, so that the boards could be driven more easily into the ground. He concluded to set these pieces eight inches into the ground, and this required them to be twenty inches long in all.

So he proceeded to make a drawing of one of these end-pieces, with the corners cut off as much as he thought was best.

It is not really necessary to draw a plan in case of so simple a piece of work as this, but in all complicated undertakings it is very important to do so, in order to make everything come out right in the end; and John determined that in all his work in his shop, whether it was anything simple or difficult that he undertook, he would proceed in a careful, deliberate, and scientific manner.

After having drawn his plan, John set the board up before him on the bench, as he had seen Ebenezer do in similar cases, and proceeded to "get out his stuff," as the carpenters say. He was contented to make the top-board the first day, and took another day for the two ends. When all three of the pieces were ready, he took them over to Mary's garden, and set up his seat in the place which Mary had chosen, by driving down the end-pieces eight inches into the ground, and then nailing the top board across from one to the other. He first made a place for the side-boards by crowding the spade down and wedging the ground open a little, and then he rammed down the earth tight about them, after they were driven.

It made a very good seat, and Mary was extremely pleased with it.

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CHAPTER XIII.

QUITE A CARPENTER.

Among the various sources of trouble and difficulty which boys experience in attempting to work with tools, or to accomplish in any way substantial and permanent results, there is one thing which is perhaps a greater hindrance to their success than any other, and a greater cause of vexation, disappointment, and failure,—and that is their *impatience*. They are so excessively eager to get a thing finished when it is once begun, that they hurry the work, and so make mistakes, and meet with accidents, which not only greatly mar the pleasure which the slow but successful prosecution of the undertaking would afford them, but are often the cause of utter failure in the end.

One of the hardest lessons which John had to learn was to be patient, and not to hurry his work, but to be willing to go slowly if he could only go surely. He was often very much disappointed in not being able to finish what he was making as soon as he expected,—though Ebenezer often told him that he ought never to set any time at all for finishing any work that he began, but to go on patiently and slowly, content if he advanced it a little every day, and leaving the time for it to be finished to come when it would, without attempting to hurry it, or anticipate it in any way.

However, in the course of the summer, John undertook and completed quite a number of works of different kinds, which cannot, however, be particularly described here. He only worked in his shop in stormy days, when he could not play out of doors. His mother preferred that, when it was pleasant, he and Benny should amuse themselves in the open air.

He at one time formed the plan of building a summer-house in an elevated part of the garden where there was a fine view. He intended to have the summer-house covered with creepers and vines, so as to form a sort of bower where his mother could go and sit and read, if she chose, or even sew, in sunny weather. But his mother did not encourage this plan, for she had observed that, however charming in a poetical sense the idea of an arbour or a vine-clad bower might be, such places were in point of fact usually far more favourite places of resort for spiders and caterpillars than for lady-occupants.

She said, however, that if John would make a *seat* there, and a good-sized trellis behind the seat, at the distance of a few feet, to keep off the morning sun, and perhaps two other trellises at the sides for wings,—all, however, to be at such a distance from the seat that there should be no danger from insects,—it might be a very good plan.

So John made the drawings for a seat and trellises on this idea. He found, however, on making a calculation of the number of pieces which would be required, and the amount of labour necessary, that it would not be possible for him to complete such a work that summer, and he determined to reserve it for winter, on days when it would be too cold to play out of doors, but not too cold to saw and plane in his shop.

And he did really make the trellises and the seat during the next winter, and he put them up early in the spring. Wilmot then made a rich bed behind each of the trellises, and planted climbing plants and runners in them, so that before the next summer was half gone, the trellises were covered with foliage, and the seat became a very pleasant place.

It is true that Mrs Gay did not often go out with her book to her work, and sit upon this seat to read or to sew, but very frequently, when she had visitors and they went out to walk in the garden, or upon the grounds, the company would often stop to rest themselves upon this seat, and view the surrounding scenery.

John made one thing in the course of the summer which pleased Benny and his little cousin Luly, Mary's sister, very much indeed, and that was a rocking-boat. Mary had asked him some time before whether he could not make her a rocking-horse, as perhaps my readers will recollect; and they may also recollect that he replied that he might possibly make the rockers, but he did not think that he could make any horse.

It finally occurred to John that he might set a *box* upon a pair of rockers, and call it a rocking-boat; and this was the plan that he finally carried into execution.

He resorted to quite an ingenious contrivance for drawing the curve to which the rockers were to be cut. He first chose a board of about a foot in width to make the rockers of, and sawed off two lengths from it, each four feet long. He laid down one of these boards upon the floor, and then going off to a distance of three or four feet, exactly opposite to the middle of it, he drove a small nail into the floor. As the floor was a rough one, such as is generally used in sheds and out-buildings, this did no damage.

He then took a long twine, and making a loop in one end of it, he slipped the loop over the nail, and then going with the other end to the board, he drew it tight to the farther edge of the board. Here he wound the twine around the pencil. Thus the twine kept the pencil always at the same distance from the nail, and by moving the point of the pencil to the right and left along the board, he described the arc of a circle upon it, from the nail as a centre. He then screwed this board in his vice, and with the shave he cut away the wood on the lower edge of it to this mark, and so gave to the edge of the board the form of a rocker.

When this board was finished, he used it as a pattern to make the other rocker by, and so he had a pair of them.

He then nailed two narrow boards across from one of these rockers to the other, on the upper edge of them, and another broader one in the middle, setting the broad one up edgewise so as to brace the rockers apart, as it were, and hold them stiff in their proper vertical position. This made what might be called a rocking-frame; and though, of course, there was no convenient place to sit upon it, Benny could not wait to have the top made and put on, but seemed to have a great desire to get upon the frame and rock himself upon it, to and fro, notwithstanding the extremely uncomfortable position he must have been in.

In due time, however, John made a sort of box, with pretty high ends, and low sides for convenience of getting in, and two seats on the inside, one at each end. This he fastened upon the rocking-frame, so as to make what he called a rocking-boat. Benny and Luly used to get into this boat, and rock themselves a great deal. They thought it was the best thing that John ever made.

The box of this rocking-boat was made to extend over the rockers on each side nearly eight inches. This was a plan which Ebenezer suggested, in order that the rockers, being thus well under the box, and out of the way, the children could not get their toes under them when standing near.

John was so careful about his work and his tools, that he very seldom met with any accident in any of his operations. One accident, nevertheless, occurred during the building of the rocking-boat, which, however, very fortunately led to no serious consequences. It seems that, after he had drawn his circular arc upon the board by means of the nail in the floor and the twine, he forgot to draw out the nail after he had done using it, and Benny, in running about there afterwards, tripped over it and tumbled down. He was somewhat hurt, and more frightened; and he made at first a loud outcry. John, however, soon succeeded in quieting him, and then drew out the nail.

Besides these, John made several other things in the course of this summer; but there is not room to describe them all here.

Although it is generally a fine thing, when working with carpenters' tools, to take a great deal of pains, and do everything in the most perfect manner, so that what you make shall have a real and lasting value, still, sometimes, when you are aiming at only some temporary purpose, a great deal of pleasure may be afforded by means of work very hastily and slightly done.

An illustration of this occurred one day, in the case of a fleet of vessels which John made for Benny, and which he and Benny sent to sea on long voyages—very long voyages they were, indeed, for the vessels never returned.

Toward the end of the summer—I believe it was in the very last week of August—John and Benny were sitting one day together upon a seat in the garden, when they heard a rumbling sound, as of distant thunder. They looked toward the west, and then they saw a range of rounded masses of clouds, rising up into the sky. These clouds were of the kind the boys call thunder-heads. They were of a dark colour in general, though the upper margins of them were here and there of a silvery brightness, which was caused by the rays of the sun reflected from them. Below they passed into a uniform expanse of cloud, which was very dark indeed, and which extended all along the western horizon.

It was from this lower expanse of gathering blackness that the sound of thunder appeared to come.

"There!" said Benny, "I hear it again."

"Yes," said John; "we are going to have a thunder-shower, and I am glad of it."

"What for?" asked Benny.

"Because then we shall have a ride to-morrow," replied John. "Mother has been planning an excursion out to Warner's Pond. She said she was going the first cool day after a rain, so that the roads should not be dusty."

"There!" said Benny; "it thunders again. There will be lightning soon."

"There has been lightning already," replied John. "It always lightens when it thunders, and it always thunders when it lightens."

"No," rejoined Benny, "for it thundered just now, and it did not lighten at all."

"Yes," said John, "it lightened where the thunder was, but we could not see it because it is such bright daylight all around us. We can never see any light that is a great way off in bright daylight. We cannot see the stars in the daytime."

"There are no stars in the daytime," said Benny.

"Yes," replied John, "there are as many stars in the daytime as there are in the night, only we can't see them."

"Oh, John!" exclaimed Benny. He was quite surprised to hear John make so extraordinary an assertion.

"Yes," continued John, "the stars stay in the sky all the daytime, just as they do in the night,—only we can't see them, because the air is so bright."

Here Benny gazed long and earnestly into the sky, but he could not detect the faintest semblance of a star, and finally said, that if there were any stars there, he was very sure that he could see them.

Just then there came a louder peal of thunder, and the boys saw Wilmot gathering up his garden-tools and putting them into the wheelbarrow, as if he was going in. So they thought they would go in to; but instead of going into the house they went to John's shop, and sat down upon a bench there, before the door which looked out into the yard.

"We will stay here," said John, "until the lightning gets too near, and then we will go into the house."

"How can we tell when it gets too near?" asked Benny. "By the brightness?"

"No," replied John, "not altogether by the brightness, but by the flash of lightning and the clap of thunder coming near together. The nearer they come together, the nearer the lightning is to us; and when they begin to come pretty close together, then we will go into the house."

"John," said Benny, after a short pause, "I don't believe there are any stars in the sky in the daytime, because there would not be any use in it."

"Then, where do you think they come from—so many of them," asked John—"every evening, as soon as the sun goes down?"

"Why, they come *out*—somehow," said John. "You see they don't light them till it begins to get dark."

Just then the clouds, which had been rapidly rising and growing very dense and dark overhead, began suddenly to pour down a shower of large drops which rattled upon the roof over where the boys were sitting, almost like hail.

"Ah, ha!" exclaimed John, in a tone of great satisfaction. "Do you hear that? We shall have our excursion to-morrow, you may depend."

"Is Warner's Pond a good place to sail boats in?" asked Benny.

"Yes," said John, "excellent. And right behind the tavern, where we are going to stop for dinner, is a beautiful smooth beach for us to stand upon while we are sailing them."

"Then," said Benny, "I wish you would make me a boat, or a vessel, and let me carry it there in the carriage and sail it."

"Very well," said John. "I'll soon make you two or three vessels; and I'll do it now while it's raining and thundering."

So saying, John proceeded to his bench, and looking under it he selected from the blocks and small pieces of wood which were stored there three pieces which he thought were of the right size. They were about a foot long and four inches wide.

"You see I am going to make you some very big vessels," said he. "Because when you send them off a-sailing they will go away out into the middle of the pond, if the wind is fair, and if I make them pretty big we can see them a long time."

"Yes," said Benny, "I should like to have them as big as you can make them."

John took one of his boards and screwed it into his vice in such a position that with a certain tool that he had he could shave off one of the front corners of the board, so as to form one of the bows of the vessel. When he had done this, he turned the board over and fashioned the other bow. He also afterward shaved the sides away a little in a tapering direction, toward the stern, so as to give the board the shape of the deck of a vessel.

"There," said he, "surveying it with a look of satisfaction, after he had finished this work. "There! That will do for one."

"Now you must bore a hole for the mast," said Benny.

"No," said John. "I must shape all my other vessels first. One thing at a time is the rule, and that means one operation at a time, not one vessel at a time."

So saying, John laid his first vessel aside and took the next one and shaped that in the same way.

"What do you call this kind of a cutter that you are cutting with?" asked Benny.

"They call it a draw-shave," replied John. "They call it a shave, because we shave with it; and they call it a draw-shave, because we shave with it by drawing or pulling it toward us."

After shaping all three of the vessels, John put the draw-shave away.

"Now for the holes for the masts," said Benny.

"No," said John; "now for the masts themselves. I shall make the masts first, and then choose a borer to fit them."

So John looked under his bench again and brought out some slender sticks, and with his fore-plane planed them to the right size, and then rounded them.

He might have done this work, too, with the draw-shave pretty well, if he had been sure that his strips of wood were perfectly straight-grained. If the wood is not perfectly straight-grained, the shaving made by a draw-shave is apt to run in or out, following the grain; whereas that made by a plane is cut straight, the plane being kept in a perfectly straight course by the under-surface of it, as it slides along.

John soon finished his three masts, for he determined to make only three,—intending to have all his vessels sloop-rigged. When the masts were finished, he selected a proper borer, and began to bore the holes.

"Now, Benny," said he, "we need some stiff white paper to make the sails of. You must go in and ask mother to give us some."

So Benny went in and presently returned with a large sheet of pretty stiff white wrapping-paper, of the kind called cartridge-paper. John, who had by this time finished making the holes, began to cut out the sails. He made them all alike and of the form of the main-sail of a sloop, that is, rather narrow at the top and wider at the bottom,—the outer lower corner forming a point which he said the main-sheet was to be fastened to.

Then he cut a row of holes along pretty near to the straight side of the sail, intending to pass the mast through these holes, in and out. This could be easily done, as each mast was made tapering nearly to a point at the top. Then he fastened a thread, which he called the main-sheet, to the outer lower corner of each sail.

"Now," said he, "when I draw the main-sheets tight and fasten them to the pins, the sails will catch the wind."

So saying, he drove two small tacks in the wood at the sides of each vessel, near the stern, —one on the starboard side, and the other on the larboard. These, he said, were the belaying-pins.

"Now," said John, "they are all finished."

"Except the rudders," rejoined Benny. "We must have some rudders."

"No," said John; "we shall have to do without rudders. And we shall not need rudders very much, for I have set the masts so far forward that the sails will keep the vessels right before the wind, and that is all the way we expect to sail them."

Benny did not understand this very well, but since John said so, he had no doubt but that it was all right.

"Now," said John, "we will take the vessel to pieces and pack them up."

"Who ever heard of taking vessels to pieces and packing them up?" asked Benny.

"Oh, they often do that," replied John. "They build steamboats for California, I have heard, to sail on the rivers there, and take them all to pieces and carry them out there in large ships, by sea, and then put them together again when they get there."

"So saying, John took the sails off the masts, and the masts out of the vessels, and then laying the three vessels together, one upon the top of the other, he put the sails upon them, spreading them out smooth, and finally placed the three masts, side by side, upon the sails. Then he wrapped the whole up carefully in a large newspaper, which he took off from a shelf in his cupboard, and tied the parcel securely with a twine.

"There!" said he, "to-morrow morning we will put that under one of the seats in the carriage."

All this time the thunder-shower had been running its usual course, for it had been lightning and thundering and raining all the time. The boys had, however, been so much interested in their work, that they paid very little attention to the weather, except that now and then, when the lightning was unusually vivid, Benny would say, "That was a bright flash!" Other than this they took very little notice of the weather without, but gave all their attention to their ship-building.

They now, however, went to the door, and they found that the shower had nearly passed by. It was still raining a little, it is true, but the whole western sky was nearly clear. The sun, just breaking into view, was shining brightly among the falling drops; and though there was a dark and heavy cloud spreading all over the eastern sky, the gloom of it was changed into gladness by the gorgeous colours of a double rainbow.

CHAPTER XIV.

SAILING THE SHIPS.

THE next morning at breakfast, Mrs Gay informed the children that she was going to make her excursion that day, the rain having effectually laid the dust, and made the country everywhere look so fresh and green. So she authorised John and Benny to make arrangements with Wilmot about the carriage. They were to be ready at ten o'clock.

John and Benny went out together into the garden to find Wilmot, and after giving him the necessary directions, they were coming back to the house, when John suddenly turned to look up towards the vane, saying,—

"We must look and see how the wind is, Benny, so as to know whether it is fair for our vessels. It is south."

"And will that be fair for the vessels?" asked Benny.

"That depends upon which side of the pond the inn is, where we are going to stop," replied John. "We will ask mother when we go in. If it is on the south side, it will be all right, for then the wind will blow the vessels directly off the shore, out toward the middle of the pond."

The boys accordingly asked their mother, but she said she did not know much about the points of the compass, and could not tell. All she knew was that the back of the house was all shady in the middle of the day, and the back was toward the pond.

If Mrs Gay had reflected a little, she might have inferred from this that the house was on the south side of the pond. For the shadows of a house are always on the north side of it, in the middle of the day. Of course the back of the house must have been the north side of it, and as that side of the house was towards the pond, the pond must have been north of the house; or, in other words, the house must have been south of the pond.

When the carriage came to the door, and they were putting in the things, John brought his parcel to put under the seat.

"Johnny, my boy?" said his mother, "what is that?"

"Some ships," said John. "It is a fleet of ships, or at least a squadron."

Wilmot stood near the horses' heads until the party were all in, and then gave the reins into John's hands, for he was to be the driver. John was rather a small boy to drive two horses, but then he was a very careful boy, and the horses were well trained.

The carriage had seats for four inside, besides two in front. John and Benny took the two front seats, and Mrs Gay went inside. On the way they called for Mary and Luly, who were to go too. They got in with Mrs Gay, and then there were three inside.

The party then set out, and as soon as the carriage was well out of town, Luly and Mary kneeled up upon their seat, turning their faces forward so that they could look out over John's and Benny's shoulders, and see the road and the horses, and everything before them. They liked this way of riding very much.

"Now, children," said Mrs Gay, "I leave it to you to regulate the speed as you please. It is ten miles out to the pond, and ten miles back. The faster you drive, of course, the sooner we shall get through our excursion and be at home again."

"Then, John," said Mary, "let us drive very slow."

"Yes," said John; "I'll let the horses trot along just as they please."

So John put away the whip in its socket, and left the horses pretty much to themselves. They were, however, in excellent spirits, and they trotted along together at a very good rate, turning their heads now and then toward one another, with a knowing look, which seemed to say, "This is just what we like."

Before long, Mary spied a large flock of sheep coming along the road. As they came nearer, she perceived that they filled up the whole road, from side to side, completely.

"Johnny!" said she, "now how are you going to get by all these sheep? There is not room for even a wheelbarrow to get through."

"I am not going to get by them at all," said John. "I am going to let them get by me."

So saying, John, having now come near to the head of the flock, stopped the horses, and let them stand still in the middle of the road, while the sheep—with an infinite deal of crowding and pushing, some of them even getting jammed together about the wheels of the carriage, and under the horses' heels—after a time succeeded in all getting by; and then John drove on.

The man who was driving the sheep nodded to John as he passed, and said, "Thank you, sir." He thanked him for waiting patiently and giving the sheep time to get by in their own way, instead of trying to drive through them, and so perhaps hurting some of them.

The party travelled on in this way by a winding road, through a very pleasant country, for about two hours; and then, at last, they came to Warner's inn, which stood near the shore of Warner's pond. Just before they came to the inn, there was a broad open space leading down to the shore of the pond, where people travelling along the road could drive down and water their horses.

John drove the carriage up to the door, and immediately a man came from a stable on the other side of the way to take the horses, while John helped his mother out of the carriage. Mrs Gay had a book in her hand, and a small portfolio. The landlady came to the door to receive Mrs Gay, and conducted her and the children to a very pleasant back-room, very neatly and prettily furnished, and with a very comfortable rocking-chair at one of the windows which looked out upon the pond.

"Ah!" exclaimed Mrs Gay, "this is exactly the place for me."

So she went and took her seat in the rocking-chair, laying her book and her portfolio down upon a table near her. She then took out her watch.

"Now, children," said she, "it is twelve o'clock. We shall not have dinner till one. So you may go down to the pond, and play for an hour. When it is time for you to come in to dinner, I will ring the bell, or else come and tell you."

So the boys, taking the parcel which contained their vessels, set off for the pond. They went out through an open door at the end of the entry, which led to a yard, and thence into a garden. At the foot of the garden was a gate, and passing through the gate the boys came at once to the shore of the pond.

Here they found a very small but stout and fat boy engaged in throwing stones into the water. They asked him what his name was, and he said it was Tubby. They asked him what his other name was, and he said he had not any other name. They asked him where he lived. He did not answer in words, but pointed to the tavern.

John then proceeded to untie his parcel,—Benny, Mary, Luly, and Tubby standing by and looking on,—and then proceeded to fit the masts and sails to the several vessels. There was a gentle breeze, and the first one they set off was carried along very smoothly and prettily, out into the pond. After she had gone off a little way from the land, so as to make it impossible that she could be recovered, they all concluded to make-believe that she was a pirate, or an enemy, and they began to cannonade her with stones which they picked up upon the beach.

Their fire, however, as it seems, was not very accurate, for the vessel escaped being hit, and sailed slowly off out over the surface of the pond, the sail growing smaller and smaller all the time, until it was finally lost to view.

It so happened that there was a rocky point projecting out into the water, at some distance along the shore from where the boys were standing, and the vessel in going out to sea, as John called it, passed not very far from that point.

"Benny," said John, "I wish we had rudders to our vessels, for if we had I believe I could steer them so that they would go to that point, and you and Mary could go and take them in there, and then set them a-sailing again. I could send you something for cargo."

This idea seemed to please the children very much, and John said he could make some rudders out of a shingle if he had one, and if he had a gimlet or something to bore a hole with up through the stern of the vessel to put the stern-rudder through.

He asked Tubby whether there were any shingles about the house, and Tubby said yes; and then he asked him if there was a gimlet, and he said no.

However, they all went to the house to see. Tubby found plenty of pieces of stick, and from one of these John made three very good rudders. Each rudder consisted of a thin blade, to take effect upon the water, and a round stem projecting from it upward, which was intended to be inserted in a hole which was to be made at the stern of the vessel, provided a gimlet could be found to make it.

But there was no gimlet to be found. Tubby took the boys to what he called the shop; but there was nothing there but some remains of an old plough, some broken chains, and a bench with a box of old iron upon it.

"Stop," said John, as his eye fell upon the old iron; "perhaps I can find something here that will do."

So he looked into the box and soon seized upon a pretty stout iron wire, about a foot long, very rusty, and crooked at one end.

"This will do," said he, "if they will only let me heat it red-hot at the kitchen-fire. Then I can burn the holes out, and that will do just as well as to bore them."

So they all went to the kitchen, though Tubby said it would not do any good, for Patience, the girl who was at work there, was very cross. Tubby proved to be right, for when John appeared at the door and asked leave to heat his wire at the kitchen-fire, she said, "No, indeed!" If there was anything she hated, she said, it was to have children poking about her kitchen-fire.

"Then will you give us some matches?" asked John, "and we will build a fire for ourselves down by the pond."

"Yes," said Patience, "I'll give you matches, if you'll go off and not let me see your faces here again."

So John took the matches, and they all went together, carrying the matches and the wire down to the shore, and there they built a fire of sticks upon a flat stone, in which John soon heated his wire so as to burn the holes. The stems of the rudders fitted into the holes very well; but before they got ready to sail the vessels, Mrs Gay came down to call them up to dinner.

After dinner they went back and sailed the two remaining vessels very successfully. By means of the rudders, John succeeded in steering them so that they went to the point, and there Mary and Benny received them. Luly remained with John to set the vessels off. The cargoes consisted of some little round cakes which they brought from the dinner-table, and also of some raisins and almonds.

When the two vessels had both been despatched, John and Luly went to the point, and there, after receiving the vessels when they came into port, they ate up the cargoes, and then set the vessels off again on their long voyage across the pond. They watched them as they sailed away until they disappeared from view, and I believe that none of the ships were ever afterwards heard from.

The party set out on their return home that afternoon at half-past three o'clock, and they had a very pleasant ride. It was a pretty long ride too, for John, in order to protract the pleasure as much as possible, drove so slowly that they did not reach home till after five o'clock.

CHAPTER XV.

HANDCARTS AND WHEELBARROWS—TAKING A CONTRACT.

JOHN had a wheelbarrow which was bought for him when he was quite a small boy; but now, though he and Benny used it a great deal, he found, as he expressed it, that it was getting a great deal too small for him. He wanted a bigger one.

The question was, whether he could make one himself.

He thought, on examining the wheelbarrow, that he might perhaps make all except the wheel. That he was pretty sure he could not manage.

He knew that Ebenezer had a wheelbarrow which he made himself, and he determined that the next time he saw him he would ask him how he made the wheel.

When at length he did ask him, Ebenezer said that he had not made the wheel of his wheelbarrow at all, but got it at a wheelwright's in the town, who had all the peculiar tools and conveniences necessary for making wheels. He advised John, moreover, not to attempt to make any part of the wheelbarrow himself.

"You see," said he, "a wheelbarrow is something that must be made both light and strong. It is easy enough to make a thing strong, if you don't mind its being heavy; and it is easy enough to make it light, if you are willing that it should be weak. But to make it strong and also light—that's the difficulty.

"And that's just what a wheelbarrow must be," continued Ebenezer. It must be strong, so as to bear the heavy loads you will have to put into it, and it must be light, so that you can easily wheel it."

"How do they make wheelbarrows light and strong?" asked John.

"They make them out of very hard and tough wood," replied Ebenezer, "and fit all the joints very closely together, and strengthen all the parts where the strains are to come with iron braces. All that you could not do.

"So I advise you," said Ebenezer, "not to try to make a wheelbarrow, but to earn money in some way and buy one. You had better buy one a size too large for you now, and then it will do for you for several years to come."

"But then," added Ebenezer, after a short pause, "I am not certain that I should not prefer a small handcart to a wheelbarrow, if I were you. A handcart takes all the load on the wheels, while a wheelbarrow brings half of it upon your shoulders."

"Then I should think that everybody would have handcarts," said John.

"No," replied Ebenezer; a wheelbarrow has its advantages. First, it does not require any road. A wheelbarrow can go where there is room for only one wheel, but a handcart must have room for two, and a broad space between them.

"Then there is some advantage, too, in having half the weight of the load come upon the arms and shoulders of the man," continued Ebenezer, "as that prevents its pressing so hard upon the wheel, and so crowding the wheel down too deep into soft or muddy ground, or making it strike too hard in going over jolts and stones. Still, I think for a boy who has good broad and hard paths in his garden and on his grounds, to do his work upon a small handcart is much better than a wheelbarrow. But then it costs twice as much."

Ebenezer went on for some time talking with John about wheelbarrows and handcarts; and there was one curious thing which he explained to him which it may be well for me to explain to the readers of this book, inasmuch as by a proper understanding of it they will learn a principle of mechanics which will be very useful to them. It is this:

If you have any load to carry upon a wheelbarrow—a big stone for instance—and you place it upon the barrow in such a position that the centre of the weight shall be exactly half-way between the wheel and you, that is, between the axis of the wheel and the place where your hands take hold, then half of the load will bear upon the wheel, and the other half will come upon your arms, and so upon your shoulders, since your arms hang from your shoulders.

If now you move the stone forward upon the wheelbarrow, that is, nearer to the wheel, then more of the weight will come upon the wheel and less upon your shoulders.

If, on the other hand, you move the stone farther back towards the handles, so as to bring it nearer to the place where your hands take hold, then a greater portion of the weight will come upon your arms and shoulders, and less upon the wheel.

"For all the paths and walks," continued Ebenezer, "about your house and grounds are hard and smooth, and the wheel can carry the load very well; whereas it is very fatiguing to a boy to have a heavy burden hanging from his shoulders, especially as the wheelbarrow jolts more or less in going over the uneven ground, and every jolt comes heavy on the shoulder and elbow-joints, and is very disagreeable when the wheelbarrow is loaded heavily.

"But it is better to have a handcart," said he, "and then you can pull and Benny push behind, and so you will get along very easily."

So John resolved that he would have a handcart.

The more that John thought of having one, the more he was interested in it. But he saw that he would be unable to make one, so he would require to purchase it. The only difficulty was to find out any way of earning the money—a pound—which Ebenezer had estimated as the probable cost of one of the proper size for him and Benny.

One day, while he was talking with his mother on the subject, she asked him how he would like to take a contract of teaching Benny his letters."

"I should be very willing to teach him his letters," said John, "if he was only willing to learn them."

"But I am willing to learn them," said Benny. "I *want* to learn my letters,—just as soon as I can."

"But, mother," said John, "I don't know exactly what you mean by taking a contract."

"When people take a contract," said Mrs Gay, "they agree to do a certain piece of work for a certain sum. They are not paid the money until the work is finished, and if they get tired of it, and don't finish it at all, then they are not paid anything at all. Even if they have *nearly* finished it, but not quite, they have no claim to be paid, provided they contracted to do the whole."

"But that is not fair," said John.

"Yes," rejoined his mother, "anything is fair that people agree to beforehand and bargain for. If you go to a shoemaker's and engage him to make you a pair of shoes, and, by-and-by, when the shoes are half done, he brings them to you and says that he has not time to finish them, he is so busy, but that they are half done, and so he wants you to pay half the money that you agreed, would that be fair?"

John laughed.

"People must consider," said Mrs Gay, "when they take contracts to do a particular piece of work, whether they will really persevere and finish it, and also whether they are willing to take the risk of sickness, or of some accident happening, to prevent their finishing it, and so losing all claim to the money.

"Now I am willing to make a contract with you to teach Benny his letters, on condition that, if you persevere and teach him all of them,—every one, so that he knows them certainly, and without any mistake,—you are to be paid the whole amount that I shall agree for. But if you don't persevere, and he does not learn them all, within the time that we shall fix, I am not bound to pay you anything. How should you like that?"

"Pretty well, I think," said John. "But how much would the pay be!"

"A pound," said his mother. "I think, as near as I can estimate, that that is about what it commonly costs to teach a child the letters. He usually goes to school one or two quarters before he has learned them perfectly.

"Still that is a pretty high price to pay," continued Mrs Gay. "Suppose there are twenty-five letters that you will have to teach him."

"Twenty-six," said John. "There are twenty-six letters in all."

"Yes," said Mrs Gay; "but I suppose he knows *o* already, and perhaps *s*. At any rate we will call it twenty-five, for easy reckoning. That is pretty good pay. You would earn as much by teaching him one letter as you would by picking up potatoes almost a whole day.

"If you can contrive to teach him one letter every day," continued Mrs Gay, "then in a month he will have learned them all, and you would have earned your money. But I will not limit you to a month. I will allow you *three* months. If at the end of three months he has not learned all his letters,—so as to know every one at once, and certainly, and without any danger of making a mistake,—then you will have no pay even for those that you have taught him;—unless indeed I should take it into my head to make you a present of some part of the sum. But that would be just as I please. You would not have any claim. So you must consider well before you undertake it."

John looked rather serious at the idea of taking such a risk.

"I expect he will trouble me a great deal," said John. "He will be playing when I want him to come and study his lesson, and so he won't come; and then he will not learn, and I shall lose all my money,—when it will not be my fault at all."

"Yes," replied Mrs Gay, "that is just the true state of the case; and that is the reason why we pay so much more money for teaching than we do for picking up potatoes,—because it requires so much skill and management to get along well with it.

"If Benny really was anxious to learn his letters, and would come of his own accord every day, and two or three times a day, to learn them, and only required somebody to tell him what they were, then, instead of being worth a pound, it would not be worth a shilling to teach him. All you would have to do would be to tell him the name of a new letter every day.

"But the trouble is that he does not wish to learn them; and if you undertake to teach him, you must have ingenuity and skill enough to interest him in it, and to lead him along, without making any difficulty or trouble. And it is by that ingenuity and skill that you will earn your money.

"People that have got ingenuity and skill can earn money pretty easily; but if they have not, then, if they wish for any money, they have to earn it by picking up potatoes, or in some such way as that."

John saw plainly that all this was very true, and he began to consider whether it was probable that he could contrive ways and means to interest Benny in learning his letters, enough to have him learn a new one every day.

An idea came into his mind of paying Benny for every letter that he learned, by making him some kind of plaything,—and also of having a black-board out in his shop, and letting Benny make the letters upon it as fast as he learned them,—and of some other similar contrivances. It seemed to him that by these and other such methods he might entice Benny along so that at least he should know all the letters within three months, and so he finally concluded to take the contract.

"Very well," said Mrs Gay; "then it is all settled, and I will draw up the writings. When people make contracts they usually write out in full what the contract is, in duplicate, as they call it; that is, they make two copies of it, on two separate pieces of paper, one for each party. Then, when both papers have been signed by both parties, one takes one of them, and the other the other."

Mrs Gay wrote the contracts that day. When they had been read and compared, and found to be alike, Mrs Gay dated them both, and then they were duly signed. John took one and put it away in his desk, and Mrs Gay took the other. Thus the transaction was completed. John immediately set to work. He found out that Benny had a great fancy for a ladder to enable him to climb up trees and walls, so he promised him that if he was an apt and willing scholar, and learned his lessons readily, that he would make him a ladder. Benny agreed at once to this, and in the next chapter we will see how it was made.

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CONCLUSION.

BENNY'S LADDER.

A LADDER, as everybody knows, consists of two side-pieces, and a number of rounds passing between them to step upon in climbing up. It is a very simple contrivance, but, like all other things contrived to answer a purpose, there is a great deal that is curious about it to one who wishes to understand the principles on which it operates, and several things are to be understood and borne in mind by any one who wishes to make one properly.

For holding the rounds and bearing the weight of the person going up, the side-pieces must be of very tough wood, so that they may be light and also strong; and they must taper a little from the bottom to the top, as they require the greatest strength near the ground.

To serve well as handles, the side-pieces ought to be rounded, especially on the outside, so as to be smooth and convenient to take hold of.

To serve well as braces to keep the ladder upright, the side-pieces ought to be at a sufficient distance apart to answer this end. Sometimes they are placed wider apart at the bottom than at the top, and this makes the ladder stand so much the steadier.

But then, on the other hand, this construction makes it larger and more inconvenient to carry about.

When Benny had learned ten letters so as to satisfy John he was in earnest, the ladder was begun. He first made the two side-pieces. He sawed these pieces out from a long board, and they were about ten feet long, that being as tall a ladder as Mrs Gay thought it safe for Benny to have.

In planing these side-pieces, John made them somewhat smaller toward one end than they were at the other. Of course the small ends were to form the top of the ladder.

He also rounded off the corners through the whole length, to make them easy to take hold of. He then laid them side by side upon his bench, and with his iron square, which had feet and inches marked upon it, he marked off the places where the holes were to be bored for the rounds. He made these holes nine inches apart, thinking that that distance was about the right height for Benny to step up, in mounting from one round to another.

After he had marked the places for these holes,—taking care to do it with great accuracy—he proceeded to bore the holes. He bored them with a brace and bit. He took care to select a bit of just the size of the broom-handles, so that they would receive the ends of the rounds into them, without any cutting.

Benny sat on the bench near John to see him bore the holes. It is very curious to see a large hole bored by means of what is called a centre-bit. First there is a sharp point in the middle, that goes in to mark the centre of the hole and guide the boring. As the workman moves this round and round, this point goes in deeper and deeper, and presently it brings down the point of a *cutter* on one side, which, as soon as it begins to touch the wood, marks out a circle upon it, just as large as the hole is to be, and cuts the circle deeper and deeper, until at length another cutter, on the other side, of a flat form and extending from the centre out almost to the circumference, begins to dip in, and cut out the chip which has been marked out by the central point and the outside cutter.

After John had made all the holes in both the side-pieces, he said,—

"Now, Benny, bring me the rounds, one by one, and we will put the ends of them into these holes."

So Benny brought the rounds, one by one, and John inserted one end of each round in a hole of one of the side-pieces. He had previously sawed off the rounds all exactly of the same length, and had also, by means of a rasp, taken off the sharp edge of the ends left by the saw, so as to round them a little in order that they might drive into their places more easily.

As fast as he inserted the rounds he drove them in with a mallet. If they had been at all larger than the holes, or rather if they had been in any considerable degree larger, he would have split the side-pieces by driving them in this way; but he had chosen a bit to bore the holes with of such a size as just to allow the ends of the rounds to be driven in.

After all the rounds were in their proper places, John went over them all again, and set them up straight and square, and then put the other piece on over them. It required some care, and not a little skill, to insert the upper ends of the rounds in the holes where they belonged, in the other side-piece; but by beginning at one end and proceeding regularly to the other, the two boys at length succeeded in getting them all in, and John then drove the side-piece down with his mallet until the ends of the rounds began to come out to the outer ends of the holes.

Then he drove nails in through the two ends of the uppermost and lowermost rounds, and this bound the parts of the ladder all firmly together. For, though only the two rounds at the extreme ends of the ladder were nailed, the others were securely confined to their places so long as the side-pieces could not spread at either end.

"Now," said John, "We will carry the ladder out and prove it."

So he took it out into the yard and set it up against the side of the house, and then he himself climbed up half-way to the top of it, and there with a sudden motion brought down his whole weight repeatedly upon different rounds, as if he were trying to break the ladder. It stood the test perfectly well. The ladder seemed stiff and strong enough to bear twice as heavy a weight as John's weight put upon it.

"There," said John, "you see it bears me very well, and of course it can't break down with only you. The only danger for you will be of your slipping, or making a false step and falling off."

Benny then went up the ladder himself, as high as his rounds extended, and after that, at John's request, he went into the house to ask his mother to come out and look at it. She was satisfied that it was strong enough, and was willing that Benny should have it, and climb up upon it. She knew, of course, very well that there was some danger of his falling,—but she thought it was necessary as a part of every boy's education that he should become somewhat accustomed to climbing, and to being upon heights, and that it was better to incur what little risk there might be of Benny's getting a fall now and then, rather than to have him grow up an effeminate and timid boy.

Benny played with his ladder about an hour, and then John took it into the shop and painted it. Benny was very glad to have it painted, both because it made it look better, and also because, as John said, it would preserve it and make it last a great deal longer. And long before the term allowed by the contract had expired, John had completed his task and earned the pound, which his mother cheerfully gave him.

I have thus followed our young friend John Gay from his first outset as a boy-carpenter up to his becoming an ingenious and a skilful workman, in possession of all the tools and appliances of one, and a workshop of his own,—all gained entirely by his constant habits of steady industry and perseverance. I trust that the simple narration of many of his attempts and undertakings will not be thrown away upon my readers. Occasionally I have described his operations in a very simple manner—so simple, indeed, that an intelligent boy may think I have been *too* simple—but that cannot be. No explanation can be *too* simple. My desire has been, so to speak, to *show* boys how to do the work themselves as well as John Gay did it; and, as he did, find in such occupations a source of great mechanical and intellectual improvement to themselves, and of pleasure and usefulness to others.

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